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EDITORIALS

COMMON SENSE IN CONDUCTING A HOUSE-WIRING CAMPAIGN.

There is probably no central-station man who does not recognize the desirability of making the load on existing lines as large as possible. In general, there are only two ways in which this can be done, the first being to increase the load of the present customers, and second, to increase the number of customers along the lines. This second avenue of new-business activity involves in nearly all cases the wiring of the premises that are to be connected, and in order to stimulate such wiring a large number of house-wiring campaigns have been carried on by the more aggressive central-station companies in recent years. As a rule, however, such campaigns have been more or less spasmodic and their results, while usually satisfactory, have been far from what they should have been.

It is interesting to note, therefore, a house-wiring campaign which involves a distinct departure from former methods in a number of respects. Reference is made to the special campaign being conducted throughout the present year by the Rockford Electric Company of Rockford, Ill., somewhat detailed mention of which is made in another part of this issue. Probably the most striking feature of this campaign is its persistence. Instead of being conducted for a period of several weeks or a month, it has already been in effect for the past six months and will be continued until next January at least. To this feature alone probably is due a large measure of success attained, because every renewed effort to call attention to the value and benefits of electric service and to the reasonable cost at which it may be secured makes a deeper impression upon those who at first are interested in merely a casual way. By such renewal of a special effort to interest prospects the advantage is also secured that attention is aroused at one time or another when the prospect finds himself in financial condition to sign a contract, whereas on the first one or two appeals he may not be in this condition. Another feature of the Rockford campaign is the spirited advertising and publicity work which is being carried out, both through the newspapers, through special circulars and by personal appeals of the company's salesmen and also of old customers.

Another striking feature is the emphasis laid on the value of electrical appliances. Usually house-wiring campaigns call special attention to the value of electric lighting, and this, while one of the most important features connected with electric service in residence districts, does not realize the maximum possibilities of such service. By laying stress on the value of electrical household utensils of all kinds in reducing the drudgery of the housewife and in increasing the comforts of the home, the double advantage is secured of interesting the women particularly and at the same time securing a much more respectable load from the customers connected. Still another aspect of the Rockford campaign is the splendid co-operative spirit in which it is being carried out. The central station is working in full harmony with leading contractors of the city and has even secured the active co-operation of its old customers. By the simple expedient of giving prizes in the form of appliances, the interest of old customers in this campaign is aroused and they are induced to work among their neighbors in the most effective way possible, since a good word from a present user of electric service goes farther with a prospect than a great deal of the special effort made by those immediately interested. Combining such a large number of valuable and yet common-sense features, it is no wonder that the campaign has been an exceptionally successful one. A study of it by other central stations should therefore prove to be very profitable.

CONTINUITY OF SERVICE.

During the early days of the central-station industry much consideration was given to the protection of apparatus and the aim of the operating man was to remove grounds and short-circuits as quickly as possible. This frequently resulted in interrupting service, as circuit-breakers were installed to protect the apparatus against overloads. As electric service spread and systems became larger, the importance of maintaining service under all conditions became a more prominent feature, and today continuity of service is regarded as one of the most essential elements of central-station operation.

Central-station apparatus today is much more able to withstand short-circuits than the earlier units. Alternating-current generation is universal on all large systems and with reactors in series with the generators there is little likelihood of damage to the latter through short-circuits on the line, as the maximum short-circuit current is limited, and may flow for a considerable time without injury to the equipment. In addition to this there is to be considered that a sudden opening of a circuit carrying a heavy current produces an abnormal voltage which may be the cause of further trouble. Moreover, the problem of re-establishing service upon a large system after it has been once interrupted is no easy matter, especially where there are a number of

generating stations operating in parallel. The re-establishment of normal voltage upon such a system to which numerous loads may be connected is not a simple matter and is generally accomplished by bringing the voltage on the line slowly up simultaneously in each station.

The modern ideal of operation is to keep the generators connected to the line and to localize any trouble which may occur and not let it affect the operation of the remainder of the system.

Operating companies have gone to considerable expense in installing equipment which will add to the protection of service. Breakdowns in apparatus are not so much feared as are service interruptions. To provide insurance against interruptions, duplicate feeders are frequently installed and in some cases feeders are ring-connected to attain the same end. Such features add to the complication of the system and provide increased possibilities of breakdowns, thereby making protection again a more complicated problem.

The important place which this subject occupies in the minds of operating engineers is indicated by the papers which have a bearing upon it presented at the convention of the American Institute of Electrical Engineers this week, there being no less than four.

The paper by Mr. F. E. Ricketts describes the means used by the Consolidated Gas, Electric Light & Power Company of Baltimore to avoid the interruption of service in the case of grounds or short-circuits. Unless the latter occur within the generator itself the relays for disconnecting the generator are not operated. When a short-circuit occurs upon the line it is assumed that if it is only temporary and will clear itself, as is usually the case, it is not necessary to disconnect the generators. Instead of this, provision is made for momentarily interrupting the field circuit, which has the effect of reducing the short-circuit current. If the ground has disappeared by the time the fields are re-established, operation goes on without more than the momentary interruption and the whole process is accomplished so quickly that the load of synchronous motors and synchornous converters is not lost. This is an important feature, as an interruption of the circuit for very many seconds will result in apparatus of this kind going out of operation and requiring to be started up afresh.

The paper by Mr. D. W. Roper shows that the Commonwealth Edison Company, of Chicago, is willing to spend considerable money in inaugurating a scheme which improves continuity of service. The scheme described consists in supplying each distribution transformer with a lightning arrester. This has greatly decreased the troubles arising from lightning, but the saving in transformer repairs is not sufficient to pay for the extra equipment. The action taken is justified only upon the basis of improving the service.

Messrs. Pollard and Lawson, of the Public Service Electric Company, Newark, N. J., show that that company has been making similar efforts to maintain continuity of service and that the design and operation of protective apparatus is carried out with this aim in view. General service must be maintained as completely as possible and trouble must be localized, and only that part of the system disconnected in which the line or equipment is unable to operate longer.

The paper by Mr. O. O. Rider, of the Public Service Company of Northern Illinois, emphasizes once more the importance of maintaining service upon a rural network. The author advocates the use of isolating transformers for the purpose of localizing troubles upon such a system. In the case of such a system, continuity of service is not to be obtained by a multiplication of transmission lines or feeders, since such a source would prove too expensive. Every effort is consequently made to supply a continuous service over the three wires of a three-phase system.

Undoubtedly the same statements would be repeated with slight, but interesting, variations if reports could be had from other large operating companies. Continuity of service has come to be the first consideration in the operation of all large systems, and protection of apparatus is made secondary to this accomplishment.

GROUNDING TRANSMISSION AND DISTRIBUTION LINES.

The old question as to whether it is better to ground the neutral point of a transmission system or high-voltage distribution line cropped up again at the convention of the American Institute of Electrical Engineers this week and proved to be one of the most interesting discussions at the convention. It does not seem to be possible to give a universal and permanent answer to this question, since conditions change from time to time and from locality to locality. The large size of many electrical systems now giving service as compared with those in existence a decade or two ago has affected this problem, as has also the greater stress which is now laid upon continuity of service.

The testimony given in the report of the Transmission Committee and in the discussion upon the floor of the convention was very conflicting and shows a wide divergence in present practice. Different operating engineers have had different experiences and have to meet different local conditions. The type of equipment used, of course, also has its bearing upon the problem.

The advantages of grounding are many. Upon a grounded system it is easier to handle disturbances, as an accidental ground completes a short-circuit and results in the rapid and sure operation of relays. Prompt disconnection of lines involved in trouble is thus secured. Grounding prevents throwing excessive voltage upon the other lines when one becomes accidentally grounded. It prevents arcing grounds and renders the location of breakdowns more easy. The grounding connection permits the operation of a three-phase system with the two remaining lines when one wire is interrupted. It also enables grounds to be extinguished by the Nicholson automatic system of grounding through a fuse.

On the other hand, the use of delta connections for transformers is desirable in certain cases and grounding can then only be effected by the creation of an artificial

neutral point. On an ungrounded system, an accidental ground at one point does no harm and does not interfere with operation. One operator reported that more interruptions to service were experienced when his system was operated grounded than when ungrounded. Grounding may consequently be advisable when duplicate feeders are available and not advisable where there are no duplicate lines. A strong argument for not grounding the neutral on power systems is avoidance of interference with adjacent telephone lines. In case of failure, the currents are larger and interference greater on grounded systems.

Where a system is not grounded, it is undoubtedly advisable to make use of an arcing-ground suppressor, as otherwise trouble is almost sure to be experienced from this cause. Another operator reported that when his system was not grounded, an accidental ground resulted in an excessive charging current which proved very undesirable. The divergence of opinion on the subject cannot better be illustrated than by the fact that one engineer advocated grounding only upon systems of low voltage, whereas another considered it desirable especially upon systems of high voltage. The problem is one which must be settled by each individual company according to its local conditions and its local experience.

LIGHTING AND SHOP EFFICIENCY.

As testimony multiplies as to the value of sufficient and correct lighting in promoting shop output, there is a more general realization of the fact that good lighting in the factory is not a luxury, but an economy. Where artificial lighting is necessary, it is best to install a system which is adequate and which by giving sufficient and proper illumination to each worker enables him to do his best work.

The intimate relation between the output of the shop and the adequacy of its lighting is discussed in this issue in an article by Mr. D. R. Shearer. He has emphasized some of the important points in this connection. He gives an illustration which demonstrates the important fact that the great question is not so much the quantity of lighting flux which is generated, but rather the methods of directing and utilizing it. A sufficiency of light flux is indeed one of the essentials, but unless it is properly utilized it is not fulfilling its proper function. Where the greatest effectiveness of the artificial light sources is secured, there will the greatest economy be attained.

We called attention a few weeks ago to investigations which demonstrated that there is a falling off of shop output at that period of the day when daylight is waning and dependence has not yet been placed upon artificial lighting. A reader of that editorial has called our attention to the fact, demonstrated in several instances, that this slackening of application on the part of the workers can be avoided by turning on the electric lights before they are really needed. If artificial light is supplied before the daylight has diminished to the point where its insufficiency is noticeable and where the rate of output has already been affected, then it is stated that such a decrease of output does not take place. It will be well for illuminating experts and factory managers to bear this point in mind and make an effort to have the artificial lighting in operation 15 or 20 minutes before the time when the worker would think of calling for it.

PREPAREDNESS.

When the plans for a new building are being laid out, and even when the building is well under way, it is often uncertain as to what the furnishing of the various rooms may be and what kind of artificial illumination will be required or desired. While it may be necessary to determine upon the position of the outlets for the electric wiring, the details of the lighting cannot always be determined. Of course, it is good practice to design the complete interior, including the lighting scheme, before the other plans are completed, but it is nevertheless a fact that this is not always done, and indeed it sometimes would be out of the question.

It consequently behooves the architect or, if it falls to his decision, the electrical contractor, to see to it that provision in the electric wiring is made for all possibilities and that outlets are provided, not merely for regulation ceiling fixtures, but for baseboards and floor outlets for supplying table lamps, etc. This applies not only to residences, but also to hotels and a variety of other structures. Not only are different possibilities in the lighting equipment to be considered, but the eventuality must be kept in mind of using various kinds of current-consuming devices.

Provision in the electric wiring for such contingencies as this represents a measure and a kind of preparedness which both architect and electrical contractor may well keep in mind.

THE VALUE OF MOVING DISPLAYS.

The electrical dealer may well pay considerable attention to the value of moving displays in increasing the figures for the week's sales. Moving displays are always of greater value than mere display of stationary objects, but in the realm of electrical appliances, perhaps more than in any other, an illustration of realistic action is especially important.

The use of the electric motor in operating any kind of a show-window or store display always results in attracting greater attention than could otherwise be drawn to the desired object. In the case of appliances which are electrically driven, a working display is especially valuable, as it illustrates more than a stationary object can the simplicity and value of the device. An electric washing machine, for example, especially if supplied with some working material, will do much more in attracting customers than an idle machine. The effect is even more noticeable when some article such as a sewing machine, for which the motor is usually sold separately, is connected up with its driving unit and made to give a continuous working demonstration of this kind.

Happenings in the Industry

American Institute Considers Grounding and Other Important Topics at Cleveland Convention—Manufacturers of Electrical Supplies Elect Section Officers—Arkansas Association Holds Annual Convention—Report of Convention-Cruise of Michigan Section, N. E. L. A.—Impressive Ceremonies at Dedication of Massachusetts Institute Buildings—Miscellaneous News Notes

AMERICAN INSTITUTE MEETS AT CLEVELAND.

Opening Sessions Indicate Convention To Be Most Successful in History of Organization.

A discussion of the advantages and disadvantages of grounding a transmission system was one of the most interesting features of the annual convention of the American Institute of Electrical Engineers which was held this week at Cleveland, O., with headquarters in the Hollenden Hotel. The convention was well attended, weather conditions were fine, and everything contributed to a very successful meeting.

The discussion on grounding was precipitated by the report of the Transmission Committee, which was prepared by Percy H. Thomas, the chairman, and presented in his absence by N. A. Carle.

The report of the Transmission Committee covered two subjects. (1) The committee has collected data and opinions as to the altitude correction to be applied to the temperature rise of electrical apparatus. Thirty-one replies were received to questions sent out, 15 being from plants at an altitude of more than 5,000 feet. Of the latter, six make no correction for altitude and six have noticed no effect of altitude. (2) Answers have also been secured giving experience with grounded neutrals on high-tension transmission lines. These show that the effect of grounding is different in different kinds of systems, sometimes being an advantage and sometimes a disadvantage. Resistance in the ground connection also alters the effect. Grounding is more often resorted to on high-voltage and complicated systems. Wooden-pole lines below 60,000 volts operate best with one line grounded.

The first part of the report was discussed by M. O. Troy, who considered most of the opinions interesting but not conclusive, owing to the fact that accurate measurements were not available.

The second part of the report was discussed by Peter Junkersfeld, E. E. F. Creighton, D. B. Rushmore, J. T. Lawson, John B. Taylor, P. H. Chase, H. L. Woodrow, D. C. Stone, F. L. Hunt, L. N. Crichton, R. F. Schuchardt, E. T. Street, Harold Goodwin, Jr., and W. A. Carter. Opinions were divided as to the advisability of grounding; some of the speakers giving testimony of successful operation under one condition and some under the other. Mr. Junkersfeld pointed out the advantages obtained by grounding on the system of the Commonwealth Edison Company, Chicago, which includes both underground cable and overhead lines, and has been operated in this manner for fifteen years. In the case of a 33,000-volt rural line, he had found it advantageous not to ground. Professor Creighton referred to the advantages of grounding, but pointed out that if proper precautions are taken, it may be advantageous not to ground. These precautions consist in using an arcing-ground suppressor and protection against high-frequency surges. Operation ungrounded provides one more chance to avoid interruption to service.

The systems of the New York Edison Company and the Public Service Electric Company, of New Jersey, are operated ungrounded. In Pittsburgh it has been decided to operate with ground in order to protect the underground cables, which have heretofore been frequently damaged by troubles originating on overhead lines. Examples were given where ungrounded lines have been operated after one of the lines has encountered a ground.

The remainder of the session on Tuesday afternoon was devoted to papers by V. M. Montsinger, entitled, "Effect of Barometric Pressure on Temperature Rise of Self-Cooled Stationary Induction Apparatus," and F. E. Ricketts, entitled "Restoring Service After A Necessary Interruption." Mr. Montsinger's paper came first.

The author has studied the variation in the loss of heat with altitude both theoretically and experimentally. Experiments were carried on at Pittsfield, Mass., and at two points in Colorado, Boulder and Leadville, at altitudes of 6,000 and 11,000 feet. Heat is lost by radiation, conduction and convection. Only convection is affected by altitude, the rate being five per cent per kilometer. The relative amounts of radiation and convection depend upon the shape and nature of surface of the apparatus, hence a shape-factor S is introduced.. The copper loss is itself affected by temperature rise, and it was shown by the author that the per-cent temperature rise is given by $AS\ (5+a)$, where a is the percentage of copper loss to total loss, and A is the altitude in kilometers.

This paper was discussed by J. M. Weed, R. W. Sorenson and A. W. Gray. Professor Sorenson's written discussion was abstracted by P. W. Traynor. He did not favor the use of Mr. Montsinger's results, but preferred an empirical correction for all kinds of apparatus. The paper of Mr. Ricketts was presented in his absence by J. T. Kelly, Jr.

The author considered, in maintaining continuity of supply, that a generator should be disconnected from the circuit not on account of any overload but only when trouble exists in the generator itself. A scheme has been utilized by the Consolidated Gas, Electric Light & Power Company, of Baltimore, in which this is realized, and the generator switches will be automatically operated only in case of grounds or short-circuit within the generator. If, however, an excessive overload is experienced, apparatus is actuated by means of relays so that the field circuit is momentarily opened and closed again, it being assumed that the source of trouble on the line will not be permanent. The generator voltage, after being interrupted, is gradually brought back to normal and the motors on the system are pulled into synchronism. Synchronous converters present a more difficult problem, which has been solved by using separate direct-current excitation of the fields. A method was also described for clearing temporary short-circuits on distribution feeders, when they are of such a nature that they are not re-established when the arc is once broken.

This paper was discussed by Harold Goodwin, Jr., R. F. Schuchardt, H. L. Woodrow, E. T. Street, G. A. Burnham, J. B. Taylor and L. N. Crichton. The author's work received much praise and conditions were considered under which the apparatus would be desirable for use.

The first session was called to order on Tuesday morning by E. H. Martindale, chairman of the local section. Floyd Waite secretary to the Director of Public Utilities, made an address of welcome in the absence of Mayor Davis. President J. J. Carty then made his annual address, dealing with the importance of industrial research. He pointed out that the American Telephone and Telegraph Company had been one of the pioneers in this work and that other electrical companies had followed the same plan with great advantage. Nevertheless, manufacturers generally do not appreciate the benefits of work of this kind. Industrial research is distinguished from pure scientific research by its motive rather than its subject matter. Research in pure science is often very valu-

able to industry and there is no danger of the industrial laboratories displacing the university laboratories in their discoveries of new phenomena. Research requires genius more than money, but when universities and technical schools have men of genius, they should not be handicapped by lack of proper facilities.

C. L. LeMaistre, secretary of the Engineering Standards Committee of Great Britain, was then introduced and made an address pointing out the developments of standardization both in England and internationally. The success of the English Standards Committee has been largely due to the democratic discussion of subjects by all interested, and no authority attaches to its standards and specifications other than that of common consent. To make standards compulsory would check progress. The Electrical Section of this Committee is consolidated with the British Committee of the International Electrochemical Commission.

The work of Mr. LeMaistre was highly praised by Clayton W. Sharp and Farley Osgood. C. P. Steinmetz pointed out that although international standardization had been interrupted by the European war, it would proceed with increased celerity after the war because the nations have been learning co-operation, which is essential in standardization.

Protective Apparatus.

A session dealing with industrial power was then held. David Hall presented a paper by Wilfred Sykes and himself entitled, "Electric Drive for Reversing Rolling Mills."

Although electric motors have been widely used on continuous mills, many motor users have felt that the reversing mill could be better handled with the steam engine. The author gives illustrations and data of electrically driven reversing mills and compares them with steam-driven mills on the bases of first cost, cost of operation, and time of operation. The types of winding are also considered.

This paper was discussed by K. A. Pauly, D. M. Petty, R. Tschentscher, T. E. Tynes, H. D. James, Brent Wiley, H. S. Page, and F. Liljenroth. Mr. Pauly objected to rating machines according to maximum torque, as this is unsafe and contrary to the standardization rules. Previous machines of the Westinghouse Company have not been rated in this manner. He pointed out the similarity and differences between rolling-mill motors and motors for mine hoists. Mr. Petty stated that flexibility of layout is one great advantage of electric drive. The commutator has proven to be one of the principal sources of trouble.

Mr. Tschentscher said that the first electrically driven reversing mill was started at South Chicago in 1905. Too much stress has been placed upon the electrical characteristics of the apparatus, whereas the physical features are of more importance. Very rapid reversal is not important, and other features of design should not be sacrificed for it.

Mr. Liljenroth, a Swedish engineer, whose written discussion was abstracted by E. A. Lof, pointed out that recent American practice was followed in Europe some years ago. A single unit is used for sizes up to 25,000 horsepower. He mentioned a line of motors running up to this capacity where the different sizes have different lengths of armature but the same diameters. Higher speeds are being used on flywheel sets.

Mr. Wiley said that greater economy was obtained in the electrical reversing blooming mill than in any other type of mill. Of the 18 electrically driven mills in this country, 13 are blooming mills, and most have been installed within 18 months.

Wilfred Sykes closed the discussion and pointed out that the capacity of a mill is controlled by the peak load which the motor can carry and not by the heating, which is a secondary consideration. In practice the ability to commutate is the limiting feature.

W. G. Taylor then presented a paper entitled, "Motor Equipment for the Recovery of Petroleum."

The use of electric motors in drilling, pumping and cleaning oil wells was considered by the author and the successful handling of this work by slip-ring induction motors was described. Special controllers are required. Pumping and cleaning are in most cases performed by the same motor. The motor is usually doubly rated, the low rating being for pumping and the high rating for pulling and cleaning. High efficiency is essential for pumping and high torque for the heavy work of pulling and cleaning the well. Data are given for conditions in California and Louisiana.

This paper was discussed by Edward Woodbury and A. M. Dudley. Mr. Woodbury said that the greatest saving by electric operation was not in drilling but in operating the well. Mr. Dudley pointed out the great advantages of the induction motor for this work.

A dinner-dance was held the evening of June 27 at which H. M. Buck delivered an address. Following this there was exhibition dancing by Miss Vida Cotabish, daughter of N. C. Cotabish, of the National Carbon Company, Cleveland.

Industrial Power Service.

The session on Wednesday morning was devoted to a discussion of protective apparatus. The following papers were presented: "Studies in Lightning Protection on 4,000-Volt Circuits," by D. W. Roper; "Experience in Recent Developments of Central-Station Protective Features," by N. L. Pollart and J. T. Lawson; "Protection of High-Tension Distribution Systems by Isolating Transformers," by O. O. Rider; "Megger and Other Tests on Suspension Insulators," by E. E. F. Creighton; "New Method of Grading Suspension Insulators," by R. H. Marvin.

Mr. Roper gave the results of investigations carried on during the past five years by the Commonwealth Edison Company, Chicago, which operates about 3,000 miles of circuits with 16,000 transformers. In 1915 three types of lightning arresters and three schemes of protection were in use. The records obtained during that year are set forth by means of maps, drawings and tables, and the results analyzed. As the result of this experience it has been decided to install hereafter a lightning arrester with each transformer, and to extend this practice to transformers already in use. It was shown that transformer troubles during lightning storms may be reduced by this means and by the removal of the primary terminal boards. Arresters installed on transformer poles are much more effective than those installed on line poles, but if the transformers are separated by more than 2,000 feet intermediate arresters should be placed on line poles. Modern types of arresters are so free from trouble that fuses in series with the arresters are not necessary. Arresters do not give total immunity from lightning troubles, but the scheme used has reduced such trouble to 10 per cent of that formerly experienced. The saving in repairs to transformers covers two-thirds of the interest on cost of arresters, maintenance, etc., and the additional expense is considered to be warranted by the improved service.

The paper by Messrs. Pollard and Lawson described the protective features used on the system of the Public Service Electric Company in New Jersey. A classification of troubles was included. The installation of aluminum-cell lightning arresters has almost completely eliminated apparatus troubles, but has not given all the protection to cables that is desired. Arcing ground suppressors have operated in every case where a fault to ground occurred during the past five years by extinguishing the arc and preventing interruption to service. It has also been a valuable protection to life. Air washers are a necessity on large turbogenerators, especially where the air contains a great many impurities. Other subjects considered were cable testing, insulator testing, connections for generator bus and exciter, the use of reactors, relays, recording instruments, dampers on air-blast transformers, coherer alarm devices and potential indicators. Thermo-couples are favored for determining generator temperatures.

Mr. Rider called attention to the desirability of localizing

line disturbances by means of transformers, especially in rural distribution systems having interconnected networks of overhead lines. The system in question operates at a pressure of 33,000 volts.

Mr. Hunt gave the results of megger tests on the disk insulators of a 66,000-volt transmission line which had been operating for 2.5 years, together with costs. Ten per cent of them showed less than 2,000 megohms. The percentage of failures in different positions in the string was given for both strain and suspension towers. The cost of testing varied between seven and eleven cents per insulator. The labor cost of replacing bad insulators was 75 cents. Laboratory tests showed that bad insulators removed from the line failed on 60-cycle tests much below spark-over value.

Professor Creighton gave the result of his experience in testing porcelain insulators. He classified the resistance of insulator as (1) distributed resistance due to water in pores, (2) concentrated resistance due to water in cracks, (3) surface leakage, (4) dielectric losses (equivalent resistances). For oscillator tests, porcelain insulators should not be partially immersed in water as has been found advantageous in testing at 60 cycles. The oscillator as recommended in a previous paper must be somewhat modified. The high-frequency, high-voltage test shows about 8 per cent more faulty porcelain than the 60-cycle test.

Mr. Marvin referred to the known disadvantages of the uneven distribution of voltage in long strings of disks. He explained the theory showing how distribution is determined by the capacities of the several units. The distribution can be improved by grading or varying the internal capacity of the units. The proposed method of grading consists in placing flat metal rings on the insulator around the cap and stud respectively, the porcelain disk being enlarged for this purpose. A simple method of measuring the voltage distribution, using a single needle gap, was described. Results of tests with and without grading were given, the graded strings showing a decidedly better distribution of voltage.

The first three papers were discussed together by E. E. F. Creighton, C. P. Steinmetz, P. H. Chase, John B. Taylor, J. O. Montignani, R. F. Schuchardt, Peter Junkersfeld, and D. B. Rushmore.

Dr. Steinmetz spoke on the importance of reliability and social duty of maintaining service. We need protection against carelessness and dirt as well as against excessive frequency, voltage or current, he said. Automatic recording devices are essential to show just what has occurred to a line.

Mr. Chase discussed the use of end reactances on split-conductor cables.

Mr. Schuchardt questioned saving life through use of arcing ground suppressors. Mr. Junkersfeld cautioned against using results of papers where they do not reasonably fit.

The last three papers were also discussed together by F. W. Peek, Jr., who pointed out the danger of misinterpreting data from insulation tests. We need a test by which the manufacturer can anticipate breakdowns of insulators on the line.

The afternoon was devoted to entertainment features, which consisted of an automobile trip through the parks, golf and tennis tournaments.

A report of the sessions on Thursday and Friday will be given in our next issue.

Papers to Be Presented at Tenth Annual Convention of Illuminating Engineering Society.

The General Convention Committee of the coming tenth annual convention of the Illuminating Engineering Society is energetically working for the success of the meeting. The tentative plans for the entertainment are illustrative of Philadelphia's hospitality. The Papers Committee reports that there are three times as many papers as can be utilized, and it regrets that the time does not permit of taking advantage of the many valuable offerings.

The following list of papers has been approved by the Papers Committee:

Colored Glasses for Illuminating Engineering, by Dr. H. P. Gage, Corning Glass Works, Corning, N. Y. This paper covers tests of various colored glasses for the production of white and other colors of light from artificial illuminants. It will include a considerable amount of new and valuable data.

Lighting of Cleveland Museum of Art, by Dr. E. P. Hyde, Physical Laboratory, National Lamp Works. After considerable experimentation, the artificial lighting of this museum has been so designed as to provide diffuse white light on the paintings. This paper is practically the report of the Lighting Committee of the Museum, of which Dr. Hyde is chairman.

Illuminating Engineering Photographs, by B. H. Norris, Illuminating Engineering Laboratory, Schenectady, N. Y. Photographs are frequently used to illustrate lighting effects. In some cases such photographs have been used which either, through the use of flashlights or other expedients, gave incorrect or false representation. This paper discusses expedients which are or are not legitimate, and urges an honest effort to encourage true representation.

Some New Phenomena of Persistence of Vision, by Dr. H. E. Ives, United Gas Improvement Company, Philadelphia, Pa. The author is well known in illuminating engineering, and his research along the lines indicated by the title, will unquestionably be a valuable contribution to the art.

The Effects of Brightness and Contrast of Vision, by Dr. P. G. Nutting, Eastman Kodak Company, Rochester, N. Y. The author, who is chairman of the Committee on Glare, has given a great deal of attention to his subject and a splendid scientific contribution may be anticipated.

Apparent Brightness and Its Properties, by Dr. L. T. Troland, Physical Laboratory, National Lamp Works. Owing to the increasing appreciation of the importance of brightness in illuminating engineering problems, this careful research, which, though conducted independently of Dr. Nutting's covers some similar ground, will be of very considerable scientific and practical interest.

Integrating Spheres, by F. A. Benford, Illuminating Engineering Laboratory, Schenectady. The practice of utilizing the sphere in photometry is growing very rapidly. The author presents considerable valuable information which will be of much interest to all having to do with photometry.

Street Lighting, by Ward Harrison, National Lamp Works, Cleveland. The author has made a number of original suggestions in connection with street lighting and this paper will undoubtedly contribute much to the knowledge of this important art.

Gas and Electric Lighting in the Home, by C. H. French and C. J. Van Gieson, Public Service Electric Corporation of New Jersey. The authors have studied this problem from the standpoint of the commercial men of the public utility company. Their conclusions will be of considerable interest to commercial men as well as illuminating engineers.

Optic Projection as a Problem in Illumination, by J. A. Orange, Research Laboratory, Schenectady, N. Y. With the widely spreading application of artificial light to stereopticons, moving fixtures, searchlights, etc., questions of projection are becoming of very considerable economic importance. The author has made very thorough investigations along this line and will undoubtedly contribute much new and valuable information.

Forced Life Testing of Incandescent Lamps, by L. J. Lewinson, Electrical Testing Laboratories, Inc., New York City. This problem is of very considerable interest to large purchasers and users. The author has had an unusually fine opportunity of working along this line with a large number of lamps.

Sections of Associated Manufacturers of Electrical Supplies Elect Officers and Appoint Committees.

The knife switch section, the porcelain section and the panelboard and switchboard section of the Associated Manufacturers of Electrical Supplies met at the Hotel Biltmore, New York City, on June 8, to elect officers, appoint committees and consider reports.

Knife Switch Section.

The knife switch section nominated J. H. Trumbull, of the Trumbull Electrical Manufacturing Company, chairman, which nomination was passed upon by the board of governors, and the appointment confirmed. T. A. McDowell, of the Westinghouse Electric & Manufacturing Company, was elected secretary, and P. J. Shelley, of the Metropolitan Electric Manufacturing Company, treasurer. The executive committee is composed of J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company; P. J. Shelley, Metropolitan Electric Manufacturing Company; J. C. Dallam, General Electric Company; A. F. Hills, Crouse-Hinds Company; T. A. McDowell, Westinghouse Electric & Manufacturing Company.

The following standing committees were appointed: Committee on knife switches, mounted on porcelain.—J. C. Dallam, chairman, General Electric Company; F. V. Burton, Bryant Electric Company; W. T. Pringle, Pringle Electrical Manufacturing Company. Committee on knife switches, mounted and unmounted.—A. F. Hills, chairman, Crouse-Hinds Company; Fred B. Adam, Frank Adam Electric Company; Warren Ripple, George Cutter Company. Committee on disconnecting and miscellaneous knife switches.—T. A. McDowell, chairman, Westinghouse Electric & Manufacturing Company; H. F. Krantz, Krantz Manufacturing Company, Inc.; F. T. Wheeler, Trumbull Electric Manufacturing Company.

An industry conference committee to act with the Underwriters' Laboratories was appointed by the chairman of the section as follows: T. A. McDowell, Westinghouse Electric & Manufacturing Company; H. R. Sargent, General Electric Company; A. F. Hills, Crouse-Hinds Company.

Many reports were made and much interest shown in the section work, and new activities were suggested for future work.

Porcelain Section.

At the meeting of the porcelain section, J. E. Way, of R. Thomas & Sons Company, was nominated chairman, and the appointment was confirmed by the board of governors. C. M. Semler, of the Pittsburgh High Voltage Insulator Company, was elected secretary and Herbert Sinclair, of the Star Porcelain Company, was elected treasurer.

Standing committees were appointed covering the various lines of porcelain manufacture, as follows: Line porcelain committee.—A. L. Wilkinson, chairman, Ohio Brass Company; H. R. Holmes, R. Thomas & Sons Company; C. M. Semler, Pittsburgh High Voltage Insulator Company; J. W. Cleveland, Locke Insulator Manufacturing Company. Special porcelain committee.—B. B. Dinsmore, chairman, Imperial Porcelain Company; Herbert Sinclair, Star Porcelain Company; Charles Howell Cook, Cook Pottery Company; Charles H. Jensen, Empire China Company; F. L. Bishop, Hartford Faience Company. Freight classification committee.—B. F. McLean, chairman, Ohio Brass Company; J. W. Cleveland, Locke Insulator Manufacturing Company; A. L. Jensen, Empire China Company; C. W. Kettron, Illinois Electric Porcelain Company; B. B. Dinsmore, Imperial Porcelain Company; H. R. Holmes, R. Thomas & Sons Company.

Various reports were made showing the progress of the work and new activities discussed for future work.

Panelboard and Switchboard Section.

The panelboard and switchboard section placed in nomination for permanent chairman Charles L. Eidlitz, of the Metropolitan Electric Manufacturing Company, which appointment was confirmed by the board of governors. D. K. Chadbourne, of the George Cutter Company, was elected secretary, and W. T. Pringle, of the Pringle Electrical Manufacturing Company, treasurer.

Standing committees were appointed by the chairman as follows: Panelboard committee.—F. T. Wheeler, chairman, Trumbull Electric Manufacturing Company; W. T. Pringle, Pringle Electrical Manufacturing Company; A. F. Hills, Crouse-Hinds Company. Switchboard committee.—H. F. Krantz, chairman, Krantz Manufacturing Company, Inc.; A. C. Streamer, Westinghouse Electric & Manufacturing Company; Charles E. Wilson, Sprague Electric Works. Knife switch committee.—J. H. Trumbull, chairman, Trumbull Electric Manufacturing Company; Fred B. Adam, Frank Adam Electric Company; T. A. McDowell, Westinghouse Electric & Manufacturing Company. Cabinet committee.—A. F. Hills, chairman, Crouse-Hinds Company; Fred B. Adam, Frank Adam Electric Company; F. T. Wheeler, Trumbull Electric Manufacturing Company.

Line Material and Lighting Fixture Sections.

The second meeting of the line material section was held at the Hotel Biltmore on June 23, at which time standing committees were appointed and other detail work was completed. A. L. Wilkinson, of the Ohio Brass Company, has been appointed permanent chairman of this section.

Edward A. McCoy, of J. B. McCoy & Son, New York City, has been appointed chairman of the lighting fixture section which was recently formed. The appointment of committees, etc., will be deferred until the next regular meeting in the early fall.

Arkansas Association of Public Utility Operators Holds Convention.

The annual convention of the Arkansas Association of Public Utility Operators was held in Little Rock on June 6-8. A very interesting program was arranged.

The papers and addresses given were as follows: "Co-operation of Association Members for Mutual Benefit," by C. J. Griffith, general manager, Little Rock Railway & Electric Company; "How to Obtain the Proper Relation Between Employees and Company," by F. Law, manager, Russellville Water & Light Company; "Twenty-eight Years of Meter Development," by C. B. Berst, Westinghouse Electric & Manufacturing Company; "The Co-operation of Manufacturers with Central Stations," by V. A. Leber, Hotpoint Electric Heating Company; "Flood Lighting and Other Methods of Modern Illumination," by P. B. Reed, General Electric Company; "The Troubles of Central Station Operators and Their Remedies," by B. C. McKinnon, manager, Eldorado Light & Power Company; "Relations of Power-Factor to Central-Station Costs," by Fred Johnson, Wagner Electric Manufacturing Company; "Commercial Publicity," by W. F. Moody, of the new-business department, Arkansas Light & Power Company.

The election of officers resulted as follows:

President, W. J. O'Brien, secretary-treasurer and manager, Henela Gas & Electric Company, Helena.

First vice-president, A. Patterson, general superintendent, Southwestern Gas & Electric Company, Texarkana.

Second vice-president, E. T. Reynolds, manager, Arkansas Light & Power Company, Paragould.

Secretary-treasurer, R. B. Fowles, auditor, Pine Bluff Company, Pine Bluff.

REPORT OF CLOSING SESSIONS OF CONVENTION OF MICHIGAN SECTION, N. E. L. A.

Concentric Wiring, Credits, Voltage Standardization, Tree Trimming and Electric Ranges Are Discussed.

While the papers and discussion on the subject of public utilities featured the first sessions of the convention of the Michigan Section of the National Electric Light Association, other problems very important to central-station men received the consideration of the delegates during the remaining sessions.

The convention, which was held during a four-day cruise on the Great Lakes, June 18-22, proved to be a very profitable and enjoyable one. The itinerary of the trip was arranged to give those on board an opportunity to see points of interest among the Thirty Thousand Islands, at Sault Ste. Marie, and the northern portion of the Great Lakes.

The report of the first and second sessions was published in last week's issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. The third session was called to order in the morning of June 21 by President S. A. Freshney, of Grand Rapids.

Concentric Wiring.

A paper on "Concentric Wiring," prepared by H. P. Eisenmenger, of the National Lamp Works of the General Electric Company, was read by J. R. Colville, of the same company. A description was given of the evolution of concentric wiring, of the wire itself and of the application of the wire and fittings for installations. European practice and results with regard to concentric wiring were described and the views of national associations concerning the use of this system were given. In the discussion, C. W. Johnson, of Jackson, asked if there was a rule concerning the installation of concentric wiring in Michigan, Mr. Colville answering that the question was to be decided by the local inspector. R. E. Keller, of Kalamazoo, asked questions regarding costs, grounding and casualties due to installations of concentric wiring. Mr. Colville quoted Mr. Eisenmenger as saying that after a wide range of investigation no casualties from fire or accidents had been reported As to costs, he said the tendency was toward a reduction in wiring prices, though it was hard to obtain definite comparisons with other classes of wiring.

Handling of Credits.

R. R. Brown, supervisor of credits, Detroit Edison Company, read a paper on the "Handling of Credits." He defined credit as the life of modern business and stated that on an average 90 per cent of all business involves credit and in some localities this figure was as high as 99 per cent. He gave an outline of credit systems, the utilization of card records for all accounts, with a separate record for delinquent accounts, and gave methods for keeping the number of delinquents low. Obtaining security for accounts was also touched upon. There was no discussion on this paper.

Voltage Standardization.

At the fourth session, held in the evening of June 21, J. R. Colville read a paper on "Voltage Standardization," prepared by M. D. Cooper, of the National Lamp Works of the General Electric Company. The important part standardization has played in the development of the electrical industry was emphasized and the lack of standardization in line voltages was pointed out. Range of voltages, such as 105 to 125 and 220 to 250, have become standard, but there is no acceptance of certain definite figures. If voltage standardization on a very few figures could be brought about, apparatus which must be closely selected for voltage, such as lamps and heating utensils, could be manufactured and distributed at less cost and with greater rapidity, resulting in benefit to the ultimate consumer. Jobbers, with the same investment, could carry more kinds and sizes of appliances, while now they carry a variegated line for different voltages. The Ohio Electric Light Association has made an effort to standardize at 110, 115 and 120 volts and has recommended the adoption of those voltages. It was stated that a number of central stations have increased their voltages (in some cases as much as 10 volts) to standard values by a gradual increase, with little or no complaint of short lamp life. The chart reproduced herewith gives a report of the shipments of Mazda lamps from the National Lamp Works over a period from 1912 to 1915, inclusive. At each voltage figure there are four lines erected, one for 1912, one for 1913, one for 1914 and one for 1915. The comparative length of these lines indicates the trend for the individual voltages. The chart shows a pronounced tendency towards standardiza-

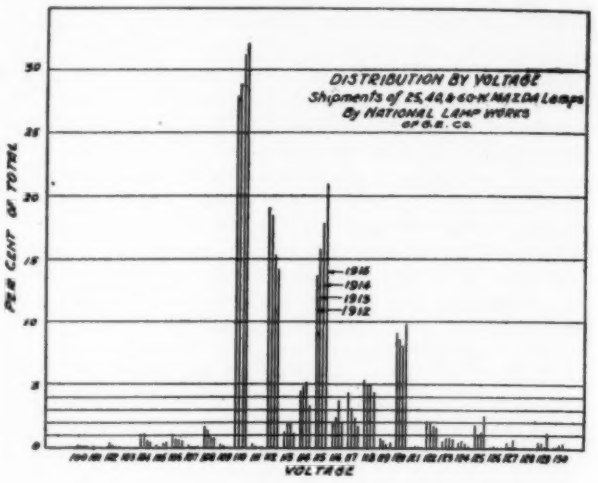


Chart Showing Tendency in Lamp Voltages.

tion for 110, 115 and 120 volts. Recounting the advantages that will accrue to the central-station industry by the standardization of voltages, the adoption was suggested to the Michigan Section of any of the three voltages named as standard for the distribution systems of its members.

In the discussion following, H. A. Fee, of Adrian, asked what reproduction might be expected in the cost of lamps if the standardization was accomplished. Mr. Colville answered that no definite figures could be given, but the tendency would certainly be toward lower prices. J. W. Trott, of Grand Rapids, said that the practice was for the central station to raise its voltage, that the socket voltage usually varied from three to five volts over or under that desired, and that there was no necessity for odd voltages. Standardization would work to great advantage in buying, trading and stocking lamps. Others who participated in the discussion were J. A. Cavanaugh, of Benton Harbor; W. J. Thompson, of Detroit, and R. E. Keller, of Kalamazoo, and these three gentlemen were appointed a committee to take care of the matter of voltage standardization for the Michigan Section.

Tree Trimming.

A paper on "The Right of Public Utilities in Michigan to Trim Trees Growing in the Public Highway," prepared by J. V. Oxtoby, of the Detroit bar, was read by Secretary Silvester. The Michigan law was quoted, as well as the opinions of Michigan courts in regard to tree-trimming cases. Comments on the subject were made by R. E. Keller, President Freshney, Secretary Silvester, and J. L. Curtss, of Coldwater. J. A. Cavanaugh said trees should be treated as of value and care used in trimming them. He told of an installation of wiring down the middle of the street and supported by span wires in order to avoid the necessity of tree trimming. R. E. Keller stated that the supervision of trimming by a state inspector had resulted very satisfactorily in Kalamazoo.

Discussion on Electric Ranges.

President Freshney introduced the subject of industrial heating devices and electric ranges for an informal discussion. Secretary Silvester stated that letters on the subject had been sent to all members of the Association during the year. Speak-

ing of practice in the Detroit territory he told of a number of installations of electric ranges, where even though the bills were comparatively high, the ranges were maintained and the owners were very well satisfied with the service.

J. A. Cavanaugh spoke of his company's experience with electric ranges in Benton Harbor, where about 35 ranges are installed. The rate for energy for cooking had been 5 cents per kilowatt-hour, with a five-per-cent discount, but was reduced this spring to 5 cents per kilowatt-hour for the first 60 kilowatt-hours, and 4 cents for excess during a month. Records of consumption by 11 ranges showed the following average monthly use over a period of nine months: Lowest, 32 kilowatt-hours per month; highest, 246, and the average, 108. The average cost was $4.68. For a family of two the cost was $1.52, and for a family of 12, $9.69. He thought electrical energy at 3 cents per kilowatt-hour will compare favorably with gas at $1.00 per thousand cubic feet, if the electric ranges were used properly. He said central stations should be careful to place electric ranges in families where one can be afforded, and that instruction should be given in handling the range and cooking with it. The inclosed oven should be used as much as possible, and much of the cooking should be done by the receding heat. He said that the load was mostly off-peak and that no need had been found for extra transformers.

H. W. Brooks, of Detroit, gave a brief outline of the successful introduction of electric ranges in Western states, and also told of the results of range installations in a Toledo suburb, where the homes are wired when new for lighting, flatiron, vacuum cleaner and range. He stated the average monthly consumption of 21 different users was 97 kilowatt-hours. The inexperienced user has a tendency to use the hot plate instead of the oven, which means inefficient operation. This is overcome in some places, though at a loss to the central station, by the combination range which has the electric oven and open gas burners.

Supplementing his remarks, J. A. Cavanaugh stated his company sold ranges at cost and charged $5.00 for the installation. The purchaser was charged $4.00 for the energy used during the first month. Thus the customer is not afraid to use the range because of the uncertain cost and is not confronted with a large bill at the end of the first month. And that period gives the demonstrator time to show how the range can be operated efficiently.

Executive Session.

An executive session was called during the morning of June 22 and various business matters of the Section were taken up. The report of the nominating committee was made, and the following officers were elected:

President, Thomas Chandler, Sault Ste. Marie.
First vice-president, W. M. Lewis, Muskegon.
Second vice-president, J. E. Stanton, Belding.
Secretary and treasurer, Herbert Silvester, Rochester.

Executive committee, S. A. Freshney, Grand Rapids; H. A. Fee, Adrian; F. A. Cavanaugh, Benton Harbor; R. W. Hemphill, Detroit, and Howard Pett, Big Rapids.

DEDICATION CEREMONIES AT M. I. T. IMPRESSIVE.

Training the Engineer for Efficiency the Keynote.

Public exercises at the dedication of the Massachusetts Institute of Technology's new buildings in Cambridge, Mass., described in the issue of June 17, were notable for the breadth of view and patriotism which breathed through the utterances of the speakers. The occasion was givan an added dignity by the presence of many of the best known and highly honored scientific men in the country, who lent their praise to the fame and promience of Technology in the field of technical education. Social features included reunions of classes dating from the earliest graduates in 1866, and a zest was added to the events of the week by excursions, parades, and aquatic, aerial and submarine events at the Charles River Basin.

The formal dedication exercises on June 14 were held in the Great Court. President Maclaurin spoke of the magnificent gift from an unknown donor which made the substantial classic group possible. "Technology's aim," he said, "is to strengthen American industry at the base by fixing it firmly on the solid rock of science." Science and industry have come to be linked in a firm union which means much to the world. The new era about to dawn will call for the scientific spirit in every phase of industry. Our prosperity as a nation depends on how firmly we grasp the truth that logical and orderly planning and execution are essential. The industrial struggle to follow the European war will demand thorough training for industrial success. If science is pursued with the same energy and intellectual power that have been devoted to business America will become the leader of the world.

Governor S. W. McCall believed the maintenance of educational institutions like Massachusetts Institute of Technology should be by individual initiation and work, rather than by state aid. The potential resources of this institution are limitless, he said. In its field it is without a rival. The mere material achievements are not of the highest importance; rather must civilization be rich in things that sweeten the spirit, and a school like this can and will minister to the highest things in life.

A. Lawrence Lowell, president of Harvard University, spoke in appreciation of the work of the Institute. The structures are built for service, though truly palatial in size and magnificence. Formerly an engineer learned his profession through practical work; the present demands scientific training in laboratory and classroom. These functions call for large and elaborate equipment.

Senator Henry Cabot Lodge closed the formal exercises with an oration, noteworthy for its brilliancy and scholarly expression. He called upon Americans to work with a full conception of their relations to the government, and to keep an open mind toward all forward movements. The address was a challenge to patriotism of the very broadest kind.

The banquet on the evening of June 14 was in Symphony Hall, Boston, and was the great festival occasion of the observances. At the head table were Dr. Alexander Graham Bell, Orville Wright, Prof. Michael I. Pupin, W. W. Bosworth, architect of the new buildings; President Lowell, President Maclaurin and other notable men. Charles A. Stone, president of the alumni, presided. Gifts amounting to almost $3,000,000 were pledged.

The "Technology telephonic survey" began at 9 a. m., when Chief Engineer Carty, of the American Telephone & Telegraph Company, and A. W. Drake, '95, introduced the audience of 3,000 to Technology men, who conversed from New York, Schenectady, Syracuse, Rochester, Buffalo, Chicago, Philadelphia, Washington, Atlanta, and cities throughout the West and South, each person in the Boston audience being supplied with a watch-case receiver. The telephone company devoted main lines for about two hours to the celebration. President Stone and Dr. Maclaurin addressed about 2,000 alumni in the 34 other cities, as well as the Symphony Hall audience, and were cheered in succession by each gathering addressed. Then followed an address by Professor Pupin and remarks by Dr. Bell and Orville Wright; a presentation of a fine volume of prints to the mysterious "Mr. Smith," the unknown benefactor; cheers, and exchange of greetings by wire between leading men in San Francisco, Seattle, Chicago and other cities and men in Boston; an address by Dr. Pritchett, ex-president of Technology, and the singing of "The Star-Spangled Banner" by diners in Washington.

The whole celebration of the semi-centennial of Massachusetts Institute of Technology and the dedication of its new plant was a distinctly epoch-marking event in American science.

Miscellaneous NEWS NOTES

Kansas City Jovians To Take Boat Trip.—The second boat trip on the steamer *Chester* this summer for the Jovian Electric Club of Kansas City, will be taken July 31. The next rejuvenation will be held the latter part of September.

Automatic Telephone System for Indianapolis.—Announcement has been made that an automatic telephone system will be installed in Indianapolis, Ind., by the Indianapolis Telephone Company. The exchange of equipment is expected to be completed in February, 1917. Contracts amounting to about $400,000 for the manufacture of the installation have been let to the Automatic Electric Company, of Chicago. Each subscriber will be furnished with new equipment.

American Electrochemical Society.—The fall meeting of the American Electrochemical Society will be held in New York City on September 28 to 30. According to the present tentative program each forenoon of these three days is to be devoted to the presentation and discussion of papers. Since this convention will be held during the week of the Second National Exposition of Chemical Industries, it is expected to utilize each of the afternoons for visiting this exposition and possibly making inspection trips in and about New York City. The secretary of the Society is Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

Consolidation of Massachusetts Central Stations Approved.—The Massachusetts Gas and Electric Light Commission has approved of the merger of the Deerfield River Electric Light Company, of Conway, with the Greenfield Electric Light & Power Company, of Greenfield. The former company was organized in 1904 to generate, buy and sell electric current, and acquired the distribution system of the Conway Electric Light & Power Company, buying energy from the local street railway. The Greenfield company has lines in adjacent towns. At present local service is confined to the hours between dusk and midnight. The Greenfield company will introduce 24-hour service and make extensive additions to the system in Conway. It already has a contract to light the streets.

Co-operative Lighting System Placed in Service in New England City.—During a recent celebration at Northampton, Mass., the business center of the city was decorated with colored electric lights, signs, emblems and stars, several large buildings being outlined with incandescent units in attractive arrangement. About 3,200 lights were employed. The interiors of buildings were provided with special electrical displays, harmonizing with the exterior lighting. It is doubtful if many of the larger cities have shown as fine electric lighting effects on any public occasion. The Board of Trade, of which J. J. Kennedy is the secretary, had an important part in arranging for the celebration, the lighting features of which were carried out by the Northampton Electric Lighting Company, C. B. Day, manager.

New Jersey Corporation Increases Capitalization.—At the annual meeting of the board of directors of the Public Service Corporation, Newark, N. J., June 20, it was voted to increase the authorized capitalization of the corporation from $25,000,000 to $50,000,000. This increase, it is stated, will be issued from time to time as requirements demand, in the form of stock issues rather than bond certificates. The directors declared a quarterly dividend of two per cent, placing the stock on an earning basis of eight per cent per annum; since last December the stock has been on a seven-per-cent basis, and prior to that time six per cent. The corporation operates the Public Service Electric Company, the Public Service Gas Company and the Public Service Railway Company, serving a total of over 300 municipalities in the state.

New Street-Lighting System in Philadelphia.—A new street-lighting system comprising 310 arc lamps mounted on ornamental poles on Broad Street, was placed in operation on June 24. The new installation completes the uniform illumination of this thoroughfare, making a total of 901 double arc lamps from one end of Broad Street to the other, a distance of 10 miles. The illumination of the street is said to be equal to 624,000 candlepower, or about 8,000 candlepower to the block. The new lamps are known as twin-arm pony arcs, and hang from ornamental poles. The installation cost the Philadelphia Electric Company $261,324, including necessary underground conduits and feed wires.

Memphis Declines Offer of Utility Companies.—Mayor Ashcropft and the City Commissioners of Memphis, Tenn., announce that they have declined the offer of the Merchants' Power Company and the Consolidated Gas & Electric Company of reduced electric-lighting rates. The offer was on condition that the city would not erect a lighting plant for a certain term of years and that it would approve a merger of the Merchants' and Consolidated companies. The present rates of both are 10 cents per kilowatt-hour and the rates proposed were 7.5 cents for the first 50 hours, 6 cents for the second 50, then 5 cents and 4 cents. It is stated that the city has practically decided not to buy the Merchants' plant, although no definite decision has been reached as to the proposed municipal project.

Enlarged Electric Plant in Hongkong, China.—Owing to the rapid development of Kowloon (Hongkong) as a business section of the colony and in anticipation of the future, the China Light & Power Company has greatly increased the capacity of its plant by the installation of a set of turbogenerators, the first of the kind set up in Hongkong, for furnishing electric power to the various industries which have arisen there during the past few years. The Hongkong & Whampoa Dock Company has of late largely increased the use of electric power, and the Chinese have become large consumers of electricity; the majority of small factories owned and controlled by Chinese have done away with a great deal of manual labor and now run their plants with motors of various capacity. The plant has been practically remodeled since its establishment in 1913 and now contains two 1,170-kilovolt-ampere turbo units. Every feature of the plant is thoroughly up to date and designed for high efficiency.

Civil Service Examination for Electrical Engineer.—The New York State Civil Service Commission, Albany, N. Y., will, on July 15, conduct a civil service examination for assistant electrical engineer of the Public Service Commission of the First District. The salary ranges from $1,800 to $2,400. Appointees to this position will have to handle a considerable amount of work in connection with theoretical computations on the design of electric railroad equipment, and should be thoroughly conversant with and experienced in the design, selection, installation and inspection of electric railroad motors, signals, switching apparatus, etc. Applicants must have had at least ten years' experience in construction or operation of power stations and heavy traction systems. Graduation in engineering from a school of the highest grade will be accepted as equivalent to four years' experience. The subjects of examination and relative weights are: Written examination, 4; experience, training and personal qualifications, 6. In rating the last mentioned subject an oral examination may be held. This examination is open to non-residents. Application blanks may be obtained from the Civil Service Commission, Albany, N. Y., not later than July 3.

Electricity in the Manufacture of Engines

The Proper Application of Electric Motors Effects Distinctive Advantages and Greater Economy in a Plant Devoted to the Manufacture of Steam Engines

Industrial Power Series—Article No. 169.

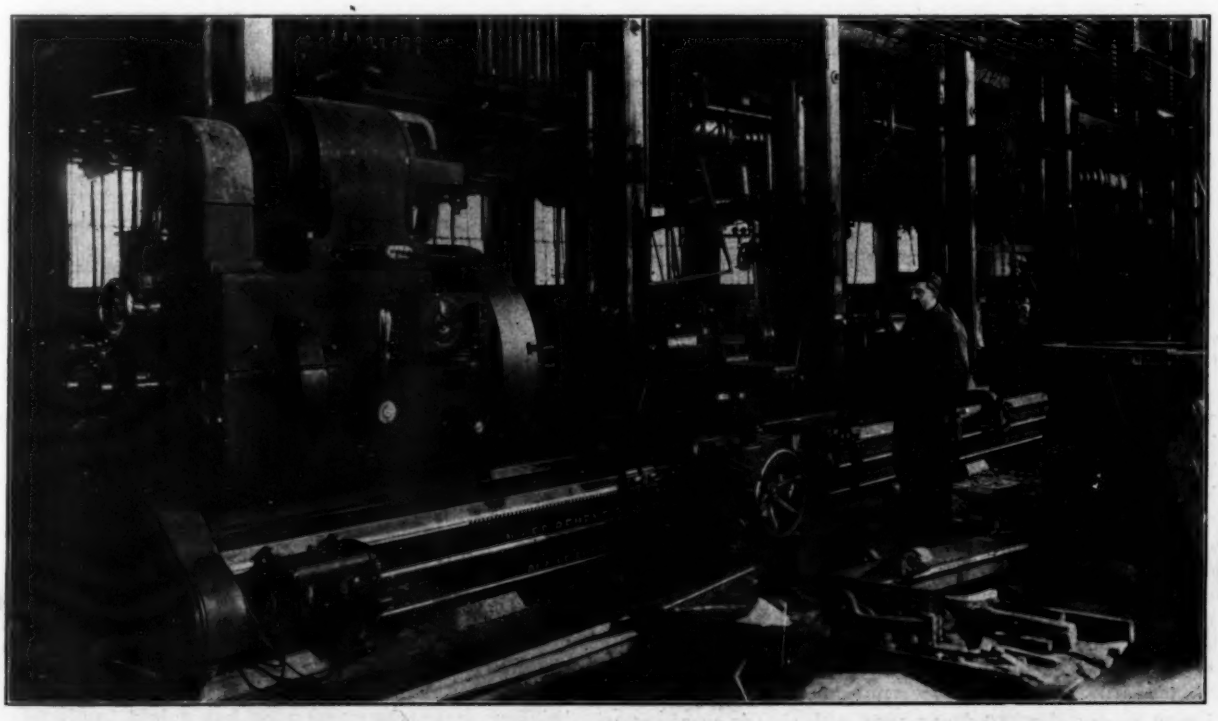
A PLANT devoted to the manufacture of steam, gas or oil engines is usually divided into five general departments: pattern shop, foundry, blacksmith shop, machine shop and the erecting shop. The equipment of the pattern shop consists of a miscellaneous group of wood-working machines. In the foundry will be found emery grinders, tumblers, sand sifters, car hoists, iron crushers and electric traveling cranes. The motor application in the blacksmith shop is the forge blower, while the machine shop includes machine tools of all kinds. In the erecting shop the motor applications are confined to portable applications, such as drills and grinders, to hoists and traveling cranes.

Pattern-shop machinery is well adapted to group drive, with possibly individual drive for the planers, which consume the greatest power. In the foundry, group and individual drive are both applicable with either direct-current or alternating-current motors, with the exception of the electric traveling cranes, which are best operated by the direct-current, series-wound motor, although there are satisfactory types of alternating-current motors for crane applications. The car hoists and iron crushers are best adapted to the use of direct-current, series-wound motors, or slip-ring induction motors. In the machine shop, for large machine tools, especially those that require variable speeds, individual motor drive is best suited to the work, while the smaller machines are best arranged for group drive. Where the buildings are widely scattered and at some distance from each other alternating-current distribution is generally the most economical.

The Proper Application of Motors.

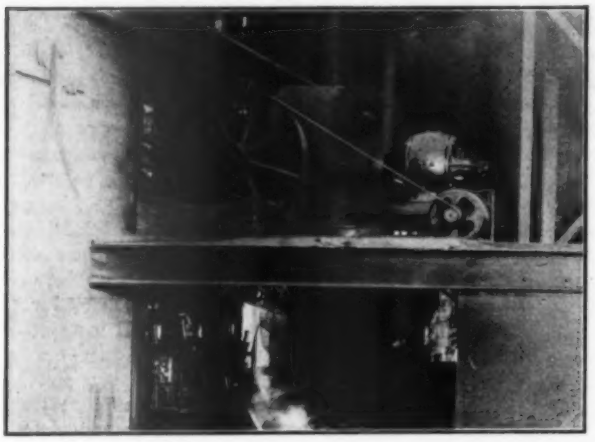
It is of the utmost importance to users of electric motors that the machines purchased be not only of high efficiency but of proper size and winding to perform the work in hand. While it is always well to purchase motors having a small margin of power above actual requirements, it is not desirable to use one much larger than needed, unless additional load is to be taken on in the immediate future. The best motors are so designed that they possess maximum efficiency for continuous running at their normal rated output, and it should be the aim to so subdivide the grouping of the machinery that motors in use may, as far as possible, operate at their maximum output. In any manufacturing establishment a number of machines will be found that are used intermittently. As a rule it is not desirable to drive such machines from motors that are driving other machines continuously, for during certain periods when the intermittently used machines are idle the motor will be working at partial load and at a point much below its best efficiency. Only during a portion of the time—when the machines intermittently used are at work—will the motor be doing its work the most economically.

In cases where a mixed load must be carried it is desirable to split the drive, using several motors and driving the intermittently driven machines in separate groups from those used continuously. In this way each motor may be worked at its best efficiency, when working at all, and a large saving in energy bills will result. There are many cases in which some machines are operated throughout the day, and in the same shop there may be other machines that are operated but one or two hours daily. The work may be so arranged that the machines necessitating intermittent operation can be used without throwing them all on at the same time. Under these circumstances a comparatively small motor running at high efficiency may be used for all these machines through the intermediary of a short length of shafting.



Engine Lathe Driven by a 20-Horsepower Direct-Current Motor, With 2-Horsepower Motor for Operating Tool Carriage.

Choice of the type of motor to be used is also largely influenced by the work to be done. Pure shunt-wound motors have very good regulation, under various fluctuations of load, after once they reach normal speed and, if the machines to be operated are well balanced, are doing reasonably uniform work and have no very heavy moving parts, the inertia of which must be overcome in bringing them up to speed, shunt-wound motors are applicable. Squirrel-cage induction motors also work satisfactorily under such conditions. The shunt-wound motor, when used to bring a very heavy piece of machinery



Sly System of Dust Removal in Foundry, Operated by Direct-Current Motors.

into motion quickly, where large inertia must be overcome, labors under great disadvantage, inasmuch as it cannot exert such abnormal starting torque as can the compound-wound motor. In case of those machines which operate under sudden intermittent loads, or which have parts whose inertia requires the expenditure of much energy to overcome, the compound-wound motors are best suited for the work, although their speed regulation is not as a rule equal to that of a shunt-wound motor.

Failure to give due weight to these considerations has often resulted in failure to get the satisfactory results out of electric drive when proper motors are chosen. Woodworking machinery, with the exception of large rotary saws, screw machines, engine and speed lathes, shapers, drills and similar machines can usually be operated with shunt-wound motors or induction motors. Punches, large shears, drop hammers, planers and the like can be operated more satisfactorily with compound motors. Cranes, hoists and winches are usually equipped with series-wound or slip-ring induction motors.

It is of great importance to the central station that motors of the proper adaptability and high efficiency be purchased by their customers, for the lower the customer's energy bills are, the more he will be justified in using central-station service, and the more attractive will a proposition be to displace engines and boilers.

Economy in Motor Operation.

It is an easy matter to show the financial aspect of a small saving in motor efficiency of which the following is an example: A 10-horsepower motor will take 10×746=7,460 watts at full load, and 5×746=3,730 watts at half load. If the efficiency is 85 per cent at full load and 75 per cent at half load, it will take 7,460÷0.85=8,780 watts, and 3,730 ÷0.75=4,970 watts, respectively. For the sake of comparison, assume another motor of the same rating with a full-load efficiency of 75 per cent and at half load 65 per cent. Then the corresponding assumptions are 7,460÷0.75=9,950, and 3,730 ÷0.65=5,740, respectively. The difference in consumption between the two motors at full and half loads are 9,950—8,780 =1,170 watts, and 5,740—4,970=770 watts, respectively. Working 10 hours a day, 300 days a year, with electric energy at 10 cents a kilowatt-hour, a saving of one of these motors over the other at full load would be:

1,170×10×300/1,000=3,510 kilowatt-hours.
3,510×$0.10=$351 per year.

At half load:

770×10×300/1,000=2,310 kilowatt-hours.
2,310×$0.10=$231 per year.

Motor Applications to Machine Tools.

Machine tools are the most important motor applications in engine-building plants and speaking broadly they may be divided into two general classes, those with direct rotary motion of either work or tool, and those with a reciprocating motion of either work or tool. The first class comprises boring mills, milling machines, drill presses, etc., while the second class includes shapers, slotters and machines of similar character. The adjustable-speed motor has a decided advantage in the way of economical production when applied to machine tools. With the old methods of speed variation by means of cone pulleys or nests of gears only coarse increments in speed are available, which invariably means that the machine tool cannot be worked up to the limit of its producing capacity. With new high-speed steels necessitating greater pulling power from the belts and increased strength in the gears reasonably fine increments in speed are almost impossible, due to the great length of the cone pulleys or to the large size of change gears required to obtain the necessary range of speed variation. The adjustable-speed motor actually decreases the cost of a machine tool by eliminating the bulky and expensive speed-changing devices.

In general, motors used for lathes, boring mills, drill presses and similar machines should be of the shunt-wound, adjustable-speed type with good inherent speed regulation. Machines having a reciprocating motion are from their nature less productive than machines having a purely rotary motion of either cutter or work. For this reason it is especially important that machines having a reciprocating motion be run at the limit of their capacity. This, of course, requires an adjustable-speed motor, similar to the motor described in connection with rotary-motion machines, except that in case of machines having a reciprocating motion the compound-wound motor should invariably be used. The compound-wound motor is useful because at the moment of reversal of the machine tool, when the torque required of the motor increases very considerably above the

Sand Sifter Operated by One-Horsepower Motor.

normal, the compound winding assists materially in holding the inrush of current within reasonable limits.

Advantages of Electric Drive.

Advantages of electric drive for engine manufacturers are many and varied. As a rule the buildings are more or less scattered and unless electric-motor drive is used there are three alternatives: running steam mains to engines in the various buildings, rope transmission or heavy belts, and individual

steam plants in various locations, all of which are inefficient and expensive in upkeep and attendance. Friction losses where mechanical transmission is used amount to a large percentage of the total power requirements, as will be seen by referring to Table No. 1. It frequently happens that it is desirable to

TABLE NO. 1.
Power Loss in Line Shafting.

	Total Horsepower	Percentage of Total Power to Drive Shafting	Horsepower Absorbed Per 100 ft. of Shafting
Light machine work	40	5.1	2.75
Heavy machine work	168	5.4	8.55

operate one or two departments or a few machines overtime or on Sundays or holidays. Where motor drive is used this is easily accomplished, but where mechanical transmission of power from a central source is employed the entire system of line shafting and heavy belts has to be operated to accommodate possibly one machine.

The elimination of shafting and belting adds greatly to the safety of employees, betters the lighting and improves the sanitary conditions. It has already been pointed out that increased production results from motor drive by the elimination of mechanical speed-changing devices. This increased production is further added to by reason of the fact that machines can be located for the best sequence of operations without regard to the location of line shafting. Machines can be added as needed and new buildings erected and the power requirements taken care of by running a few extra feeders.

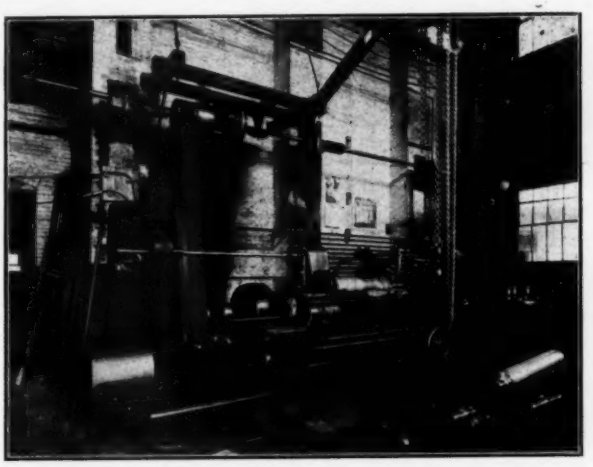
Another important feature of manufacturing establishments is proper ventilation. To procure fresh air and to keep it in circulation is a problem of particular interest to those who are compelled to be either temporarily or permanently indoors. In summer, especially, and in inland and low sections of the country, arrangements for good ventilation become a matter of business necessity to render the shops even inhabitable during the hot months, and in winter it is an equally important matter. For such ventilation it is not only necessary to draw in pure air, but to remove the vitiated air, and to continue the process indefinitely. For many industrial purposes, however, the desired object is to remove noxious gases or fumes, or to cause a circulation of air over heated or cooled pipe-coils. To accomplish these results a motor-driven fan of the propeller type is usually fixed in a circular aperture in the wall and can

Corner of Blacksmith Shop, Showing One of the Motor-Driven Blowers.

be arranged as desired, either to draw in fresh air or expell bad air. An exhaust fan should be placed so that it discharges the air in the same direction as the prevailing wind, in order to avoid wind pressure. The number and location of air inlets and probable effects of prevailing air currents should also be considered in determining the place for the fan. Under ideal conditions the room to be ventilated should have only one inlet for air which should be at the opposite end of the room from the exhaust fan. The size of the fan depends largely upon local conditions, but roughly speaking, the 18-inch size will be found sufficient to provide fresh air for 25 or 30 persons. This allows for the provision of 2,000 cubic feet of air per hour for each occupant of the room.

Pattern-Shop Equipment.

In connection with the machinery equipment, pattern shops present no special features different from many woodworking shops. The machines generally include planers, band saws, circular saws, jig saws, wood lathes, drilling machines and the



Grinding Machine Driven by a 25-Horsepower Direct-Current Motor.

like. The wood commonly used for patterns is pine and in engine works patterns many times assume large proportions, especially for such parts as bases, columns and fly-wheels.

Foundry Equipment.

In the foundry, more complicated processes are involved. Various grades of iron are used, depending upon the part to be cast. A flywheel, base or column may be composed of varying proportions of pig iron and scrap iron such as old car wheels. The car wheels have to be broken and this is done by a simple device similar in construction to a pile driver. The wheel is placed on the ground under the weight and the latter is lifted by a motor-driven hoist and in falling breaks the wheel. Coke for charging the cupola is generally stored in a nearby building and that together with the iron from the storage yard is elevated to the charging room of the cupola building either by an elevator or a car on an incline. In both cases motor drive is best adapted to the work.

Cupolas consist of hollow cylindrical steel structures lined with fire brick. Provision is made for air pressure and drawing off the molten metal into large and small ladles lined with fire clay. The large ladles are handled by electric traveling cranes and placed over the molds where they can be tilted by

TABLE NO. 2.
Power Required to Drive Cupola Blowers.

Diameter, Inside Lining, Inches	Capacity per Hour, Tons	Pressure per Square Inch, Ounces	Volume of Air per Minute, Cubic Feet	Horsepower
18	0.25-0.5	5- 7	150- 300	0.5-1.5
24	1-1.5	7- 9	600- 900	2-6
30	2-3.5	8-11	1,200- 2,000	5-15
36	4-5	8-12	2,200- 2,800	10-23
42	5-7	8-13	2,700- 3,700	12-32
48	8-10	8-13	4,000- 5,000	18-45
54	9-12	9-14	4,500- 6,000	22-60
60	12-15	9-14	6,000- 7,500	30-75
66	14-18	9-15	7,000- 9,000	35-90
72	17-21	10-15	8,500-10,500	45-110
78	19-24	10-16	9,500-12,000	52-130
84	21-27	10-16	10,500-13,500	60-150

means of a hand wheel. Table No. 2 gives horsepower requirements of foundry blowers. In Table No. 2 the melting capacities do not give the maximum melting capacity per hour for high-grade cupolas, but represent common practice under ordinary conditions. The distance from the base of the cupola

to the lower side of the charging door constitutes the charging space. In all cases 10 inches is taken as the distance from the sand bed, after it has been formed on the bottom of the cupola, to the lower side of the tuyeres, and the fuel consumption is based on this figure. Fuel consumption increases with the depth of the bed. In charging a cupola the first layer is fuel, including kindling material and coke, then a layer of iron followed by another layer of coke and so on alternately until the level of the firing door is reached. As the fuel burns and the iron melts the charges are renewed until the required amount of iron has been drawn off. About 30,000 cubic feet of air are consumed in melting a ton of iron, which would weigh about 2,400 pounds, or more than both iron and fuel. The most rapid melting is not always obtained by forcing the largest quantity of air possible into the cupola, as too much air absorbs heat and retards combustion.

Blacksmith-Shop Equipment.

As stated before, the principal motor application in the blacksmith shop is the blower for the forges, but frequently

TABLE NO. 3.
Motor Rating Required for Volume Blowers.

No. of Fan	Horsepower for 1.5-Oz. Pressure	Horsepower for 2-Oz. Pressure	Horsepower for 3-Oz. Pressure
3	0.75	1.10	2.00
4	1.25	2.00	3.50
5	2.00	3.00	5.25
6	2.75	4.00	7.50
7	3.50	5.50	10.00
8	4.50	7.00	12.75
9	5.75	9.00	16.00

hammers are motor-driven. Large hammers for heavy work are generally steam-operated. Table No. 3 gives horsepower requirements for volume blowers. Table No. 4 gives air-com-

TABLE NO. 4.
Power Required to Drive Air Compressors.

Diameter of Cylinder	Stroke in Inches	R. P. M.	Piston Speed Feet per Min.	Capacity in Cu. Ft. Free Air per Min.	Horsepower
6	6	150	150	29	3.5-5.5
8	6	150	150	51	3.5-6
10	6	150	150	81	4-5.5
8	8	150	200	69	9-13
10	8	150	200	108	10-13.5
12	8	150	200	156	10-14
10	10	150	250	134	18-26
12	10	150	250	194	19-26
14.25	10	150	250	266	21-26
16.25	10	150	250	384	18-27
12.25	12	150	300	236	34-45
14.25	12	150	300	317	35-45
16.25	12	150	300	414	37-45
18.25	12	150	300	526	28-47

pressor data. Air compressors form part of the equipment of an engine plant and are used to supply compressed air to air hammers, riveters, air hoists, chippers, etc.

Machine-Shop Equipment.

Aside from the regular machine tools in the machine shop there are generally a number of special machines. One is a portable drill, motor-driven, which has a bail attached for convenience in transporting by the cranes. The drill can be placed on top of columns, bases or cylinders or carried about the shops to facilitate work. Another special machine is the flywheel lathe which is used to finish flywheels when too large to be placed in boring mills. It consists of a shaft and bearings connected by a nest of gears to the driving motor. The flywheel is assembled on the shaft and is revolved by the motor drive. A suitable slide rest is provided for the lathe tools.

In connection with the cranes, too much care cannot be taken in their equipment and extremely heavy loads are transported. Effective electromechanical brakes should be provided and provision made for dynamic braking as well as safety stops to prevent a lift that endangers the breaking of the sheaves and stretching the hoisting cables. Another important feature is a brake for the bridge, either mechanical or electrical, to stop the bridge travel in case of current interruption. Table No. 5 gives load-factors and average kilowatt-hour consumption for pattern shops, foundries, blacksmith shops and for machine shops.

Electrical construction is an important factor in the satisfactory operation of the electrical equipment and experience has shown that in machine shops, foundries and blacksmith shops cleat-and-knob wiring is not economical on account of the continual danger of mechanical injury and the effects of gases on the insulation. Rigid conduit work is the most economical construction in the end. It is desirable to have plenty of outlets, about six feet above the floor, for connecting portable tools

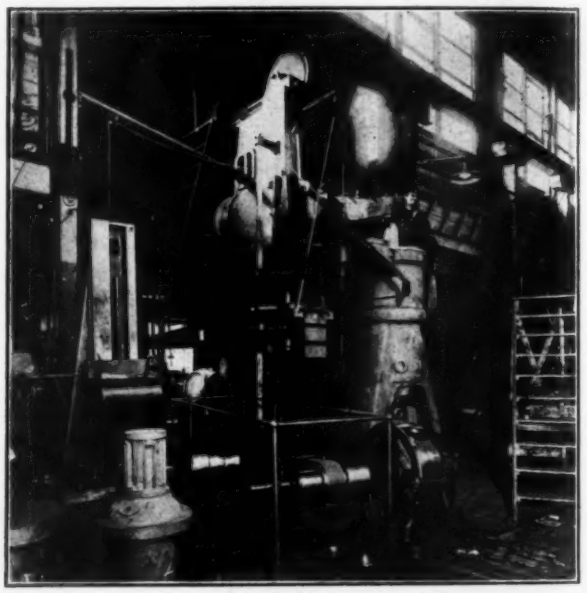
TABLE NO. 5.
Load-Factors.

(Load-factor here signifies the ratio of the actual energy used in kilowatt-hours to the maximum kilowatt-hours which would be used were the motors to run at full load for 350 hours a month.)

	Average KWH. per Mo. per H.P.	Load-Factor Per Cent.
Blacksmith shops (group drive)	84.0	32.0
Foundries (group drive)	114.0	43.7
Foundries (individual drive)	55.7	21.3
Machine shops (individual drive)	42.8	16.5
Machine shops (group drive)	89.7	34.4
Pattern shops (group drive)	67.6	26.0

and extension lamps. The electrician's department should be supplied with an ample equipment for all emergency repairs to facilitate rapid work in case of breakdown.

All motors should be regularly inspected and it is good prac-



Vertical Boring Mill Driven by a 15-Horsepower Direct-Current Motor.

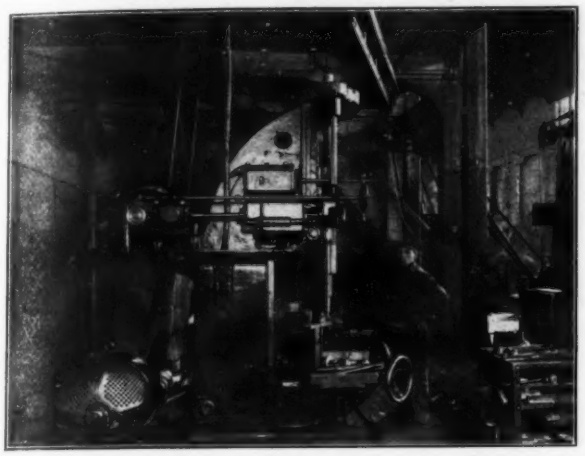
tice to have a metal card rack adjacent to each motor with blank spaces to be filled in by the attendant giving time of inspection, conditions, oiling, repairs and the nature, if any, name of attendant, etc. These cards should be collected at regular intervals and filed by the chief electrician.

McIntosh & Seymour Corporation.

To illustrate the practical application of electric power in engine-building plants a description of the electrical and mechanical features of the McIntosh & Seymour Corporation's plant at Auburn, N. Y., is given. This company acquired the plant and complete organization of the McIntosh & Seymour Company and has also secured an exclusive license from the Swedish Diesel Engine Company for the United States, Canada, and all other countries and islands of the western hemisphere, except British dependencies in South and Central America and in the West Indies. The McIntosh & Seymour plant is one of the largest and best equipped in the country, and for many years has been noted for an output of steam engines of the highest class.

Electrical applications in this plant are particularly interesting on account of the gradual transition from a 110-volt, direct-current system to a 110 and 220-volt, direct-current and a 60-

cycle, three-phase, 440-volt, alternating-current system. An outdoor transformer installation connecting with the lines of the Empire Gas & Electric Company furnishes current for the induction motors and also supplies a motor-generator set consisting of a synchronous motor and a 110 and a 220-volt direct-current generator. A three-wire distribution system is operated from the 220-volt, direct-current machine, giving 110 and 220 volts. In conjunction with the central-station service there is a steam-engine-driven, 110-volt, direct-current generator of 300 kilowatts capacity and an alternating-current generating unit consisting of a Diesel engine and a 200-kilovolt-ampere, 60-



Drill Press Driven by a 15-Horsepower Direct-Current Motor.

cycle, three-phase, 480-volt generator operating at 200 revolutions per minute.

Before going into the details of the installation, a brief description of the product of this corporation will aid in giving an idea of the requirements of engine-building plants. The types of Diesel engines built are standard four-cycle engines of from 40 to 1,000 brake horsepower; special high-speed four-cycle engines for submarines, high-speed vessels, and other service requiring high-speed engines of small and moderate powers; standard four-cycle stationary engines up to 3,000 horsepower; four-cycle marine reversible engines of similar design for passenger and cargo vessels and yachts. Individual "A" frames and a box-type frame for the entire unit are used.

There are a total of 51 motors in the McIntosh & Seymour plant, 22 of which are 110-volt series-wound, direct-current crane motors on seven electric traveling cranes. The motor equipment includes both direct-current and alternating-current motors as already stated. Later installed machine tools having variable-speed characteristics are equipped with 220-volt, adjustable-speed motors, while constant-speed machines and groups of machines are driven by induction motors. Steam power is used for driving a portion of the machine shop but it is the intention to divide the line shafting and group drive the machines by motors. The various departments include the pattern shop, foundry, machine shop, blacksmith shop and erecting shop, aside from numerous smaller buildings used for various purposes. The crane equipment includes 40 and 20-ton cranes in the erecting shop, 20 and 10-ton cranes in the machine shop, and 20, 10 and 5-ton cranes in the foundry.

Taking up the various departments of the plant in logical sequence, the equipment of the pattern shop first demands attention. The machines, consisting of two band saws, four wood lathes, joiner, surface planer, two buzz planers and a planer knife grinder are group-driven by a 35-horsepower, 110-volt, direct-current motor operating at 1,150 revolutions per minute and equipped with a 10-inch pulley having a 12-inch face.

The foundry equipment is diversified. In the coke building, where the coke for charging the cupola is stored, there is a 15-horsepower, 110-volt motor, operating at 1,225 revolutions per minute and equipped with an 8-inch pulley with a 7-inch face. This motor operates a freight elevator and an iron breaker in the iron yard by group drive. The iron and coke are hauled up to the charging room by a car on an incline, the car having a capacity of approximately five tons. This car is pulled up by a hoist mechanism operated by a 15-horsepower, 110-volt compound-wound motor running at 1,300 revolutions per minute and equipped with an 8-inch pulley with an 8-inch face. This motor also furnishes power for a tumbler and an exhaust fan for removing the dust from the latter machine. There are two 12-ton cupolas to which air pressure is furnished by three fans. There is a direct-connected, motor-driven blower operated by a 30-horsepower, 440-volt induction motor, a No. 7 Sturtevant foundry fan driven by two 35-horsepower, 110-volt, direct-current motors, running at 1,150 revolutions per minute, one motor belted to each fan pulley; and a second fan of the same make, No. 8, having a similar motor equipment. It is the intention to displace one of these outfits by the motor-driven blower.

In the department of the foundry where the castings are cleaned there is installed a Sly system of dust removal which removes the accumulation of sand in the air when the castings are being cleaned by sand blast under pneumatic pressure. The sand dust is drawn into a large metal tank by means of a fan direct connected to a 10-horsepower, 110-volt, direct-current motor operating at 1,150 revolutions per minute. The sand-laden air is forced through cloth screens where the sand adheres. It is removed from the screens by an agitator, belt-driven by a one-horsepower, 110-volt direct-current motor equipped with a 3-inch pulley with a 2.5-inch face. The sand thus collected is used for further casting cleaning. Near this combination there is an emery grinder and a 36-inch by 4-foot tumbler, group-driven by a 7.5-horsepower, 110-volt, direct-current motor operating at 815 revolutions per minute and equipped with a 10-inch pulley having a 6-inch face. For handling the cores in the core room there is a Yale & Towne hoist driven by a one-horsepower, 110-volt, direct-current motor, operating, at 1,000 revolutions per minute through chain and sprocket drive. Sand for moulding purposes is sifted by a Goul & Eberhardt sand sifter belted to a one-horsepower, 110-volt direct-current motor mounted on top of the machine. The motor op-

Sixteen-Foot Boring Mill Operated by a 50 and a 7.5-Horsepower Direct-Current Motor.

erates at 1,000 revolutions per minute and is equipped with an 8-inch pulley with a 3-inch face. In connection with the foundry there is a carpenter shop for repairing flasks in which there is a 5-horsepower, 110-volt, direct-current motor operating at 960 revolutions per minute and provided with a 7-inch pulley having a 5-inch face. This motor group drives a cross-cut and a rip saw, rod-straightening machine, and a shear.

In the blacksmith shop there are two motors driving blowers for forges. There is a 5-horsepower, 110-volt, direct-current motor operating at 1,725 revolutions per minute, provided

with a 6-inch pulley with a 5.5-inch face, belted to a No. 4 Sturtevant blower. A second blower outfit consists of a 3-horsepower, 110-volt, direct-current motor operating at 1,650 revolutions per minute driving a forge blower. This motor is equipped with two pulleys, 12 inches in diameter with 4-inch faces, each pulley being belted to one fan pulley. The air is used for four forges and a heat-treating furnace.

The machine shop has a number of interesting motor applications among which may be mentioned a Niles-Bement-Pond engine lathe, 24-inch swing and 29-foot bed. The lathe is driven by a 20-horsepower, 220-volt, adjustable-speed motor through gearing. The normal speed of the motor is 1,150-1,200 revolutions per minute and is provided with an automatic starter. The tool carriage is motor operated through bevel gears by a 2-horsepower, 220-volt, direct-current motor drive by a 20-horsepower, 220-volt, adjustable-speed motor operating at 4,800 revolutions per minute with the controller on the carriage. The master controller is operated from a handle which is also located on the tool carriage. The other individual motor applications are enumerated in the motor data sheet. In

MOTOR DATA SHEET—McINTOSH & SEYMOUR CORPORATION, AUBURN, N. Y.

No.	Horsepower	Speed in R. P. M.	Application.
1	35	1,150	Two band saws, 4 wood lathes, joiner, surface planer, face plate lathe, 2 buzz planers, planer knife grinder.
1	15	1,225	Freight elevator, iron breaker.
1	15	1,300	Exhaust fan, tumbler, car for hauling iron and coke.
1	30	-------	Cupola blower. Induction motor.
2	35	1,150	No. 7 Sturtevant foundry fan.
2	35	1,150	No. 8 Sturtevant foundry fan.
1	7.5	815	Two wheel emery grinder, 36-inch by 4-foot tumbler.
1	1	1,100	Yale & Towne hoist.
1	1	1,000	Gould and Eberhardt sand sifter.
1	10	1,150	Sly system dust removal.
1	1	-------	Sly system dust removal.
1	5	960	Rod straightening machine, shear, cross-cut saw, rip saw.
1	5	1,725	No. 4 Sturtevant blower for forges.
1	3	1,150	Blower for forges.
1	3	1,650	Centrifugal pump.
1	5	1,150	Norton grinding machine.
1	20	1,625	Blanchard vertical grinding machine.
1	15	700-1,400	Colburn drill press.
1	25	715	Landis grinding machine.
1	50	625	Horizontal boring mill, 16-foot.
1	7.5	1,000	Horizontal boring mill, 16-foot.
1	20	1,150-1,200	Niles-Bement-Pond engine lathe.
1	2	4,800	Niles-Bement-Pond engine lathe.
1	15	670-840	Vertical boring mill for columns.
1	10	1,130	No. 4 Sturtevant exhaust fan, three stands two-wheel polishers, No. 11 Besley grinder.
1	3	1,025	Pond radial drill.

the polishing room there is an equipment of three stands of double polishing wheels, a No. 11 Besley grinder and a No. 4 Sturtevant exhaust fan for removing the dust from the polishing wheels. These machines are group-driven by a 10-horsepower induction motor with a 10-inch pulley having a 6-inch face.

In the erecting shop there is a 3-horsepower, 110-volt, direct-current motor direct-connected to a centrifugal pump of the vertical type for circulating water to the engines under test. This motor operates at 1,150 revolutions per minute. Fuel for the engines under test is pumped to the erecting shop from two 1,000-gallon tanks, beneath the ground outside of the buildings by a triplex pump geared to a one-horsepower motor. One tank contains crude oil and the other tar.

A Trackless-Trolley Battery Vehicle.

We illustrate herewith a new motor wagon designed by C. J. Spencer, general manager of the Bradford (England) municipal city tramways, employing the chassis of an old electric trackless trolley car and taking energy from the overhead trolley wire, or fom its own self-contained battey equipment. The wagon can be coupled up instantly with the tramway service and run at similar speeds as the passenger cars. When necessary, detachment also can be made instantaneously and the vehicle run for short distances, up to a few miles, without any aid from the trolley wire. The equipment of the chassis of this railless trolley vehicle is identical with the ordinary railless trolley vehicle used in Bradford, namely, two 20-horsepower motors with ordinary series-parallel control, and operating on a 500-volt circuit. The grounding device is an extension of the steering arm of the vehicle bearing on the track

Trackless Trolley Vehicle Equipped With Storage Battery.

by the medium of a cast-iron block and at the same time automatically steering the vehicle. This device has been used with considerable success for some time in connection with the ordinary trackless trolley cars at Bradford when taking them over the tramway routes to the depot. The batteries employed are of the Edison type—120 cells giving a normal voltage of 150 volts. They supply current to the ordinary 500-volt motors, the only difference being that the motor with battery supply runs correspondingly slower; that is, pro rata to the voltage, but as the torque of a series motor is proportional to the current passing through the windings, the vehicle is capable of climbing steep gradients, but at a speed corresponding to the low voltage. While the vehicle is running on the 500-volt circuit the battery may be in series with the motors, thus charging them while the car is in trolley service. The battery is capable of running the vehicle about 10 miles. The change over from battery to overhead wire is merely a question of throwing over a switch, the putting of the trolley on the wire, and the ground connector on to the steering gear.

July Iron Sale At Kansas City.

The Kansas City (Mo.) Light & Power Company bought 10,000 electric irons, which sell at $3.50, and will put them on sale for July at $2, "nothing down, eight months to pay." The only advertising until July 1 is on the bills payable on July 1; as a result of these bills, and of a few hundred circulars accidentally put into the hands of the company's distributors, 500 irons have already been sold. It is said that the use of an iron brings a revenue of about $5 a year to the company. The advertising to be used mentions the secondary rate, and the use of an iron ordinarily puts the consumption of current into the secondary rate class.

Large Hydroelectirc Project in Vermont Approved.

The Public Service Commission of Vermont has granted a certificate of "general good" to incorporators of a company to be known as the Central Power Corporation of Vermont, which proposes to develop a hydroelectric plant at the Gorge of Middlebury River and distribute energy for power only in 12 cities and towns, and also for lighting in seven communities.

Simple Chart for Finding Plant Efficiency

By W. F. Schaphorst

This simple chart enables the manager or operator of any steam-electric generating plant to determine in a few moments the over-all or thermodynamic efficiency of his plant. In other words, it shows the ratio of the electrical energy delivered at the switchboard to the total energy in the coal used. The method of finding the logarithmic scales for the chart is explained so that the chart can be extended to larger or smaller values.

HIS chart will be found useful for determining the over-all thermodynamic efficiency of an entire power plant, from coal to switchboard, without doing any figuring. Just lay a straight edge across the chart a couple of times and the answer is found closely enough for all practical power-plant purposes.

For example, I have shown on the chart how simply this is done. In a certain power plant the total kilowatt-hours generated were shown at the switchboard for one month as 1,055. During the same period 10,000 pounds of coal were burned, the coal having a heat-value rating of 12,000 British thermal units per pound.

First lay the rule on 12,000 (column *B*) and 10,000 (column *E*) and locate the intersection *d* with column *D*. Then lay the edge on that intersecting point *d* and the kilowatt-hour reading 1,055 (column *C*); the over-all efficiency is directly found in column *A*. The answer is 3 per cent.

The chart is so constructed as to have a range that can be easily extended enough to cover almost any steam-electric power plant in the world. It does not matter much whether the readings cover a period of one week, a month, or a year, except that the longer the period is the more accurate the result is liable to be.

It may be of interest to readers to explain the method followed in making a chart of this kind. In Fig. 2 I show the method in a way that I think will be understood by anybody who understands a slide rule.

The slide rule is based on logarithms, and so is this chart. So, I find that the quickest way to develop a chart of this sort is to copy the scale directly from a slide rule, or from logarithmic paper, such as can be purchased from dealers in drafting materials.

Thus, referring to Fig. 2, the length of column I represents the logarithm of 4. The distance from 1 to 3 represents the logarithm of 3. The distance from 1 to 2 represents the logarithm of 2, and the same is true for all intermediate points.

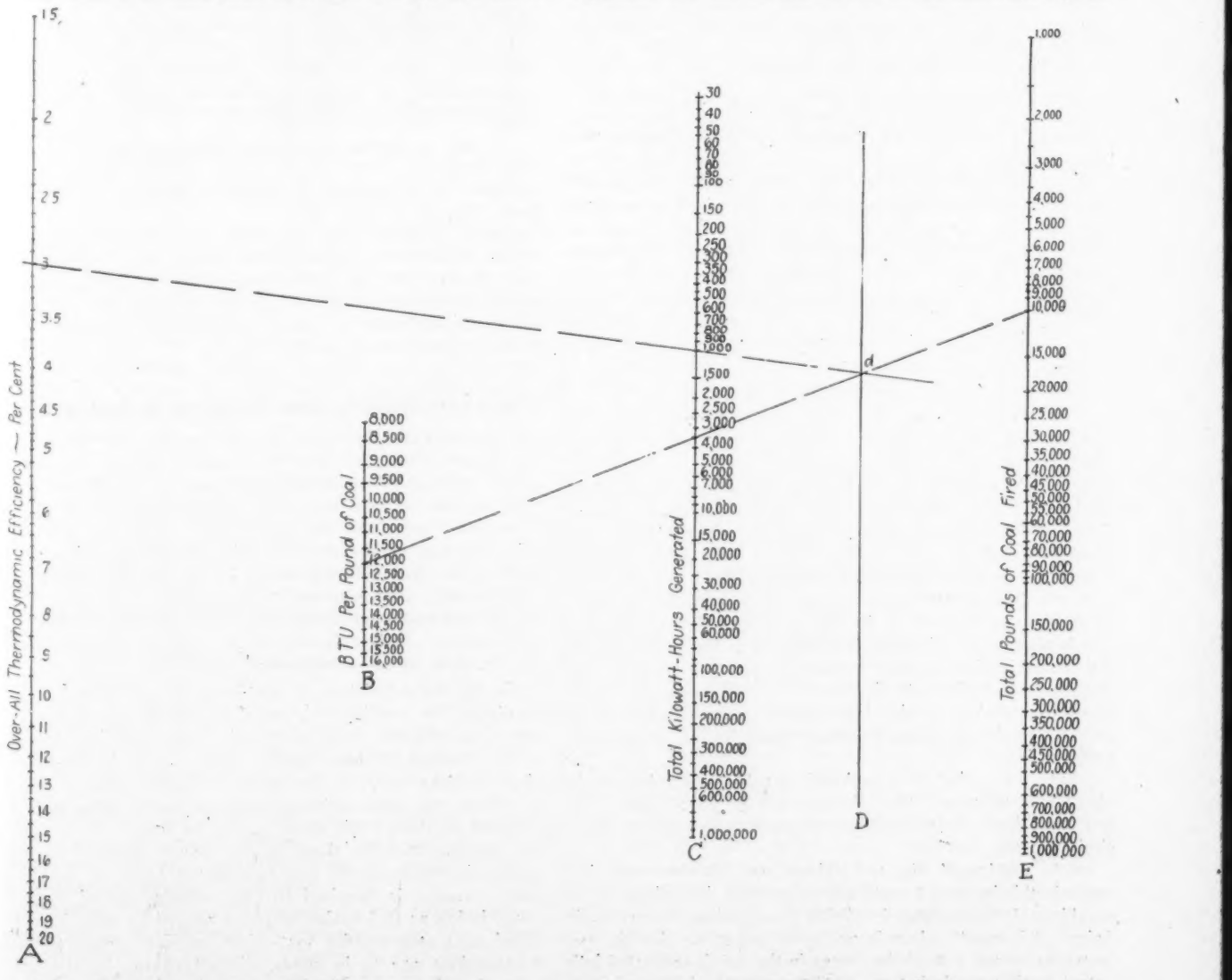


Fig. 1.—Chart With Logarithmic Scales for Quickly Finding Over-All Efficiency of a Steam-Electric Plant.

It will be noted that column III is identically the same as column I. Locate it any convenient distance to the right or left of column I and parallel to it. I have placed it on the right.

Now, the logarithmic scale in column II may be developed in the way that I have indicated by the cross lines. Perhaps I can show it plainly as follows:

Column I.		Column III.		Column II.
1	×	1	=	1
1	×	2	=	2
2	×	1	=	2
2	×	1.5	=	3
2	×	2	=	4
2	×	2.5	=	5
2	×	3	=	6
2	×	3.5	=	7
2	×	4	=	8
3	×	2.5	=	7.5
3	×	3	=	9
3	×	3.33	=	10

and so on. It is plain that by continuing this method and extending it, every necessary division can be found in column II. However, on the slide rule the scales I-II are exactly one-half the length of the scales III-IV, and on this chart it will be noted, that scale II is a one-half reduction of scales I and III and lies exactly in the center between I and III. This is true because in multiplication we have the familiar logarithmic formula that,

if $A \times B = C$

then $\log A + \log B = \log C$.

Referring to Fig. 2, it will now be understood that the middle column (II) is just a representation of the sums of the logarithms in column I and column III.

Take the limit of the scale, for example:

$$4 \times 4 = 16$$

$$\log 4 + \log 4 = \log 16.$$

Upon this simple principle, then, all logarithmic charts of this type are based.

To extend the chart a little further, I have added the parallel column V, and have multiplied a few numbers in it by numbers in column II. The results will be found in column IV, and it will be noted that column IV must be a one-third reduction of columns I, III and V, and the horizontal distance of II to IV is exactly one-third of the distance between column II and column V.

Column II.		Column V.		Column IV.
1	×	1	=	1
1	×	2	=	2
2	×	1	=	2
4	×	1	=	4
5	×	2	=	10
10	×	2	=	20
16	×	4	=	64

In case it should be desired to lay out a larger scale than obtainable from a slide rule or from logarithmic paper, dimensions may be obtained from any table of logarithms in our standard handbooks or trigonometrices. This, however, is a rather slow process. To get around that method, the slide-rule scale may be enlarged by use of a pair of proportional dividers, an accurate pantograph, or by means of a good straight edge.

It is plain, after this brief description, that the accuracy of a chart of this kind depends much upon the care taken by the draftsman in laying out his lines. The slide rule, as we all know, is accurate to a fairly high degree. If made as accurately as a slide rule, these charts will therefore be just as accurate as the slide rule.

I have found that the logarithmic paper mentioned above is also highly accurate. There is therefore no good reason why any logarithmic chart should not be accurate enough for practical purposes.

In the making of Fig. 1, I did not use "extreme care" because in this instance I could see no necessity for doing so. In speaking of thermodynamic efficiency we seldom, if ever, split hairs. It is usually given in an "even" per cent. We say, for instance, "15 per cent of the energy in the coal is converted into actual work"; we do not say, "15.091 per cent of the energy in the coal is converted into actual work."

The reader has doubtless discovered already just what I did in making Fig. 1. It is clear that numbers in column B multiplied by numbers in column E will give the total heat units liberated in column D. It is not necessary to show any numbers in column D, because the point of intersection is sufficient. In the example cited here the intersection point *d* in column D would be 120,000,000 British thermal units.

Now, by reversing the process described as to Fig. 2, we can divide the numbers in column II, for instance, by numbers in columns I or III. If we divide by numbers in column I, the quotient is found in column III.

In Fig. 1, therefore, I am merely dividing the numbers in column C by the numbers in column D, and the quotients are found directly in column A.

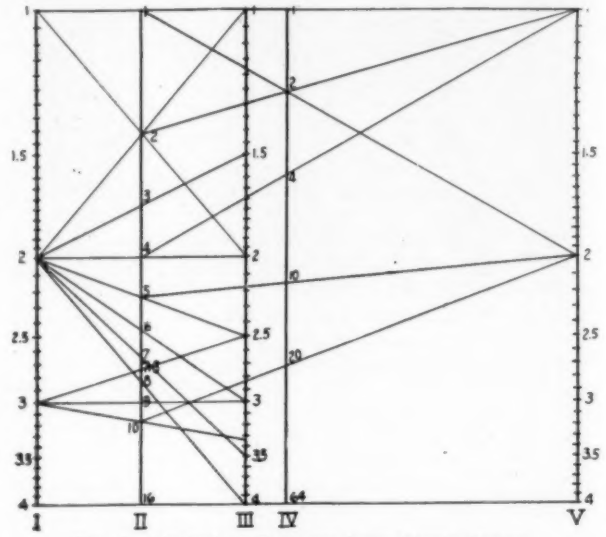


Fig. 2.—Method of Deriving Logarithmic Scales.

Actually, judging from the other columns, the figures in column C should represent British thermal units utilized. Indeed, the total kilowatt-hours *do* represent the British thermal units utilized, and the figures I show were obtained by dividing British thermal units by 3412.66, because there are that many British therma units in a kilowatt-hour.

Franchise Negotiations Progress in Lexington.

With the exception of a few details, the city officials of Lexington, Ky., and the Lexington Utilities Company, which is expected to be the purchaser, are understood to have agreed on the terms of the franchise soon to be offered for sale, the franchise under which the lighting company now serves the city being about to expire. The draft of the franchise was made by the Utilities Bureau of Philadelphia, after experts representing it had gone over the ground and after conferences with officials of both city and county. It is referred to as a model contract, from the viewpoint of the municipality.

Among the provisions of the franchise as drafted is one requiring the company to keep all schedules relating to rates and charges open for public inspection, no changes to be permitted in either without written authorization of the city. If either party to the contract should desire a change to which the other will not consent, such matter will be referred to three arbitrators, one to be named by city, one by company and the third by the county judge of Fayette county in the event the first two cannot agree on the third. The company is required to obey regulations of the city commission as to location of poles and wires, and the commissioners may require that wires be placed underground. Connections are to be made without charge by the company for the occupant of any premises not more than 50 feet from a direct wire of the company.

Artificial Lighting and Shop Production

A Discussion of the Relation Between Efficient Artificial Lighting and Production in An Industrial Establishment

By D. R. Shearer

WITHIN recent years there has been developed a science made necessary by keen manufacturing competition and efforts of industrial managers to get to the bottom of production costs, known generally as efficiency engineering. That a study of the fundamental production factors of industrial plants has been of great benefit no one doubts, for the many individual enterprises to which a knowledge of these factors has been applied with marked success toward increasing production or decreasing unit cost stand as witnesses to actual results.

The efficiency factors in production are many and varied but may be grouped under three general classes, executive, mechanical or productive machinery and labor. Efficiency in the executive department and of mechanical equipment has been carefully covered in detail by many writers on the subject and so have most of the factors bearing on the efficiency of labor. But one of these very important points relating directly to the quality and quantity of output from labor has, it seems, been slighted in actual practice. This result is probably due to an underestimate of the relative importance of the subject as bearing on real efficiency. The economic factor referred to is artificial illumination and it is the desire of the writer to outline briefly some of the relations light may bear to the economy of production.

To secure the greatest efficiency from any workman, it is necessary that he have a desire to work and the requisite facilities for performing the given task with ease and facility. The ambition or desire to produce or succeed in a given labor is a phychological factor of achievement and proceeds from a feeling of comfort, physical and mental well-being and contentment. The fact is realized by those who furnish to their employees good ventilation, warmth, comfortable environments and suitable sanitary conveniences. Considerable attention is paid also to the proper location of windows or skylights for the admission of adequate light during the day. It is the opinion of the writer, however, that the proper artificial lighting of the shop is of greater economic importance than any other one physiological or psychological aid to production. Were it not for the human element in manufacturing production, light could be dispensed with entirely in the ordinary establishment without affecting the economy of output costs in the least. Thus, it is an element bearing directly on the labor of employees and is therefore not easily evaluated in terms of dollars and cents nor even in an economic percentage.

Lighting Requirements.

In considering the efficiency of lighting we find two prerequisites to the attainment of the results desired:

(1) The proper location, arrangement and intensity of light sources, or in other words, the lighting factors bearing on the workmen, either in a physiological or psychological manner.

(2) The attainment of lighting-system efficiency, or the use of highly economical sources of light and properly reflecting or diffusing reflectors, from an electrical and illuminating engineering standpoint.

The human eye being accustomed to the natural light of day, which is a diffused and reflected light from surrounding objects, is especially adapted to that light and any other illuminant varying from daylight in quality, direction or source of intensity must necessarily create an abnormal condition, in a sense, on the delicate retina. The eye, probably the most useful organ of human sense, is so closely related to the physical and mental condition of man that abnormal conditions of light must certainly create other abnormalities either in mind or body.

The eye, however, is inherently one of the most perfect self-adjusting mechanisms known and adapts itself without volition even to great changes in quality and quantity of illumination, thus, to some extent mitigating abnormal conditions that might otherwise become very pronounced. Much could be written regarding this subtle relation between the eye, as affected by variations in light, and the physical functioning of other organs. In fact, many volumes might be cited dealing with ocular lesions brought about by the improper use of illuminants, but in this connection we shall dismiss from present consideration all but those conditions resulting from the effects of light which appear to bear on the efficiency of labor.

Correct illumination creates a feeling of cheerfulness, activity and alertness, both mental and physical, illustrated by the fact that natural daylight is more coducive to the satisfactory performance of practically all work.

Incorrect illumination, if the light is insufficient, creates a feeling of lassitude, slowness and gloom, very strikingly shown by the effects of natural darkness falling upon those people removed from any considerable quantity of artificial light. On the other hand, too great an illuminating intensity creates oversensitiveness, nervousness and mental strain; and badly directed light may be the cause of actual ocular lesions accompanied by pain.

In securing proper lighting, we find certain conditions inherent to the building under consideration, such as the reflective coefficients of the ceiling, walls and equipment installed, as well as the height of the ceiling and location of windows. Of course, if the greatest lighting economy is to be secured, we must have in mind a proper layout from the preliminary building plan to the ultimate completion of the plant, but if the building is already complete, we are circumscribed to minor changes and to refinishing the interior and relocation of lighting units. It is not generally realized that the interior finish or painting of a mill building has a direct bearing on the cost and effectiveness of lighting, but such is the case.

Clothing-Factory Installation.

It is not in the province of this brief article to discuss the means of attaining a proper illuminating layout for a given plant, as this depends on many variable conditions and is a problem for the consulting engineer having charge of the design, but to call attention to the importance of proper lighting as an economic factor. It may not be amiss, however, to outline a specific case of improvement in a plant we now have in mind, that of lighting a clothing-factory sewing-machine table.

The lighting was done originally by 32-candlepower carbon lamps, placed every four feet along the table and between the machines which were supposed to furnish adequate light for two sewing-machine operators. Thus, placed over 100 lineal feet of this table there were 25 of these lighting units, consuming a total of 2.5 kilowatts, which at six cents per kilowatt-hour amounts to 15 cents per operating hour. These lamps were shaded with a fairly efficient type of reflector, but even at that some glare reached the eyes of the operators and sharp shadows

were cast on the table and work by the machine arm.

To bring about an economical change in lighting conditions a small six-candlepower, six-volt Mazda lamp, fed from a special low-voltage transformer, was placed on each machine arm, about four inches above and slightly back of the needle and so shaded by a steel reflector that the light was restricted to a small circle of approximately 80 square inches on the work surrounding the needle and cast practically no shadows. By the use of this method of localized or specific lighting the illumination was placed exactly where needed without waste and on account of the short distance between the lamp and the goods the intensity was increased about 300 per cent on the restricted area above the intensity formerly obtained. A general illumination over the tables was furnished by ten 40-watt Mazda lamps in diffusing-type steel reflectors, placed at a considerable height above the operating plane.

Considering now the current consumption under this method we have 50 six-watt lamps or 300 watts and in addition ten 40-watt lamps or 400 watts over the tables, making a total of 700 watts and costing 4.2 cents per hour for operation.

Not the least factor in efficiency gained in this plant was the reduction in the number of spoils or garments of inferior workmanship, since this loss was reduced over one-half as a direct result of properly controlled and properly proportioned illumination.

While this example is given merely to show in figures how adequate light may bear directly on production cost, it is not an unfair sample of a generic gain in factory economy.

At this time, as never before, are found the means for applying the efficiency test to lighting equipment as electrical and illuminating engineers are ready and willing to assist and they have at their command almost innumerable types of reflectors, such practical data and highly developed sources of light. Considering the source of light alone, without regard to the reflective coefficients of different types of reflectors, it is to be noted that we may secure from the latest lighting units eight times the quantity of light per unit of electricity that was possible from those available some ten years ago.

Since light is such a prominent factor of production, where daylight is not available throughout the whole working period, and since we have the means and the knowledge with which to bring this factor to its maximum efficiency, there is no reason why every plant owner should not carefully consider the possible results of efficient lighting to his own gain.

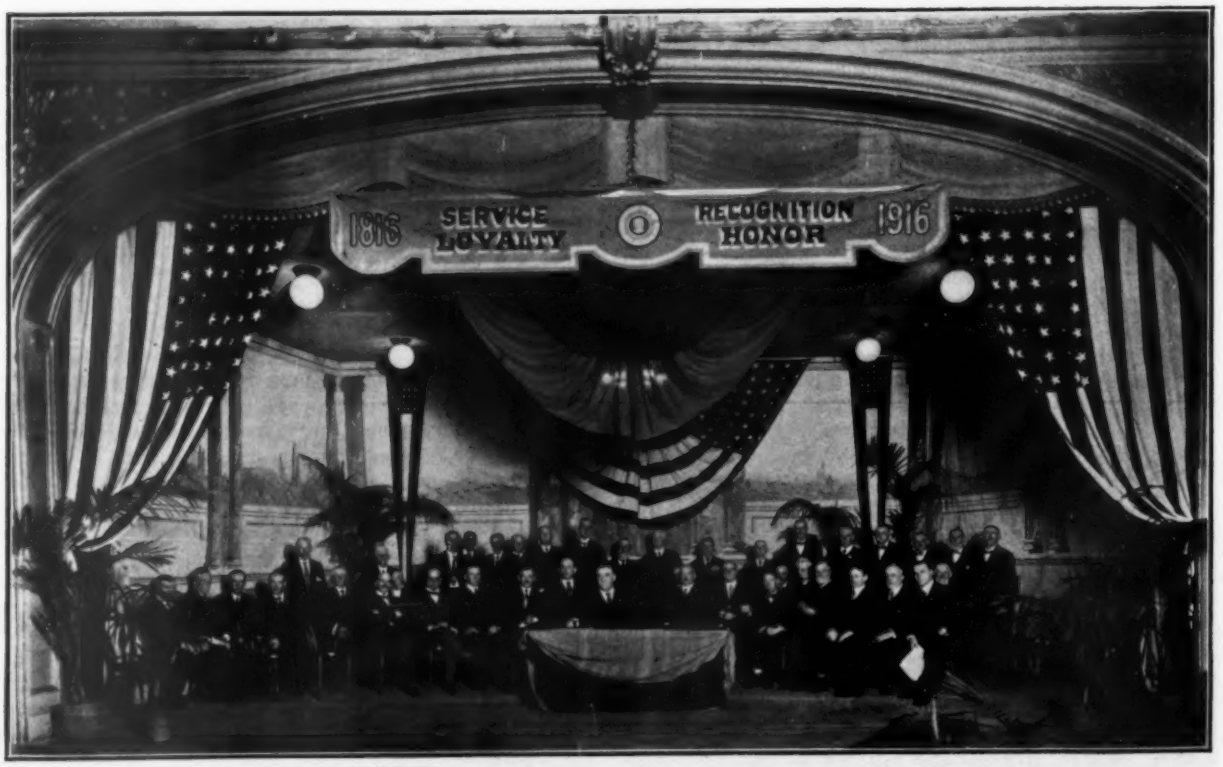
Hydroelectric Development in Prospect for Maine.

A temporary power plant is installed for power service in connection with the construction of a large hydroelectric development of the Cumberland County (Me.) Power & Light Company, at Hiram Falls, on the Saco River. A concrete-brick station, with electrical apparatus to generate 2,400 kilowatts and a steel transformer station, are features of the new plant. Water power will be brought to the station through an 11-foot Oregon fir penstock 450 feet long, and a dam will be constructed part way up the fall. W. G. Elliott is in charge of the construction work.

The company has been granted authority by the Public Utilities Commission to issue, at 94 and accrued interest, $350,000 of first and refunding gold bonds, due December 1, 1942.

Baltimore Company Awards Service Medals.

The accompanying illustration shows the officers of the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., seated on a platform with a group of old employees who were awarded medals for long time loyal service. The ceremonies incident to the award were impressive and were participated in by practically all employees of the company.



Stage of Auditorium During Award of Service Medals to Old Employees of Consolidated Gas, Electric Light & Power Company, of Baltimore.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

MERCHANDISING ELECTRIC APPLIANCES.

A Paper Prepared for the Convention of the Michigan Section of the National Electric Light Association, June 18-22, 1916.

By David R. Thomas.

Merchandising electric appliances is not a lost art because it is an art that has never, with the exception of certain recent rare exceptions, existed. Central stations have worked on the theory that they are engaged in the sale of current and have left the merchandising of electric appliances to the electric dealers. It is true that there have been campaigns in which the manufacturer, dealer and central station have joined forces and for a short space of time have conducted a most vigorous attack upon the public. The results as a rule have been gratifying to all concerned. These campaigns are spasmodic and have been confined to the low-priced and relatively large current-consuming articles, such as flatirons and toasters.

Most central stations are equipped with display rooms and maintain therein a carefully selected and well polished assortment of appliances. A well groomed, courteous salesman, who devotes the other ten hours of his day of toil to bill collecting, attending to complaints, reading meters, etc., will explain to prospective customers the advantages and comforts to be derived from the use of an electric toaster, percolator or flatiron.

The customer will be told that the electric washing machines are sold on time and that the company stands behind every article it sells. He appreciates the courteous treatment, thinks nice things about the company, probably purchases a low-priced and relatively large current-consuming article, and proceeds to use it in his home. The chances are that due to lack of facilities, or the failure of a fuse, or of the article itself, the appliances will not remain on the lines for more than a month. The salesman, feeling gratified in the knowledge that he has added from $6 to $12 to the company's annual revenue, will return to his books, meters or complaints with a lighter heart.

While the foregoing is the exact truth only in small communities, it is relatively true with the great majority of central stations. In other words, there are very few electric utility companies that are today successfully merchandising electric appliances. By "successfully merchandising," is meant merchandising on such a basis that the profit derived from the sale of appliances provides for the entire expense of the department devoted to it and at the same time is adequately taking care of the territory.

The essential features of successful merchandising might be classified as: First, service; second, incentive; third, intensive cultivation; fourth, survey; fifth, financing, and sixth, maintenance.

Service.

Service consists of rendering to the customer that of which he, the customer, not the central station, stands in the greatest need.

The public quickly learns to differentiate between a policy based upon the sale of service and a policy based only upon the sale of energy. Once let the public become imbued with the idea that the central station's sole aim is the sale of energy it will be found that the successful merchandising of appliances is next to impossible. On the other hand, the creation of the feeling that the central station is interested in the making it possible for its customer to obtain, on easy terms, that appliance which he needs most, irrespective of its current-consuming characteristics, it will build up the spirit of confidence upon which any successful merchandising plan must be based. The current consumption will take care of itself.

Incentive.

All men are not salesmen, and in building up a sales organization it might be well to bear in mind that all "salesmen" are not men. A good salesman is, as a rule, born, not developed, and to attract and hold the class of men required for a successful organization the inducement must be attractive.

The almost phenomenal results obtained by the sales department of one operating syndicate, which will be mentioned later, is largely attributed to its policy of so fixing the commission on the various appliances sold as to enable its salesman to obtain an income far above anything heretofore considered sufficient for the service rendered. It is certain that in order to obtain good men the opportunity to earn a good salary must be as great, if not greater, than in other lines of merchandising. It is also certain that a substantial return to the man selling the appliances is conducive of the encouragement and enthusiasm so necessary to success.

Probably the most satisfactory method of payment is that of salary plus commission, the salary to cover the service rendered the company in the way of maintaining appliances already sold and the commission to apply on the sale of new appliances, the commission to be paid monthly on all sales that have been approved by the sales manager.

Intensive Cultivation.

The number of salesmen required for a given population has been found to vary over a wide range. In one city investigated, there was found one to every 25,000 people; in another, one to every 6,000. In the first instance, the appliance sales ran $3,000 per month for five salesmen; in the second, the sales ran $20,000 per month for 32 salesmen. The sales per man, however, ran about the same, being $600 per month. In the first instance, washing machines and vacuum cleaners were handled by the manufacturers, while in the second instance the central station handled all appliances.

The ratio of one salesman to 6,000 of population seems nearer the proper one, as it permits of what might be termed "intensive cultivation." It is essential that to each man there should be an allotted territory which it should be his duty to periodically cover. In some instances it might be advisable to have each salesman's territory composed of part residence, part commercial or business houses and part factories. In other instances it might be better to classify salesmen on the basis of residence, commercial and power. Irrespective of varying local conditions, the

main requirement is that each customer be called upon periodically—once a month if possible—certainly once in two months.

Survey.

A necessary feature of "intensive cultivation" is the "survey." This consists of tabulating, by means of a card index system. Each card will give the location, character (whether residence, business or factory) number and type of appliance possible to install, those already in use, facilities for convenient use, etc. Space should be provided for the noting of conditions of appliances on each visit. In fact, every detail pertaining to the customer should be provided for. A residence card would set forth every convenient appliance from a bell-ringing transformer to an electric mangle. A commercial card would embrace everything from electric signs and window lighting to electric cash systems. A factory card would include everything electrical from the flood lighting the American flag to the most intricate electric appliance.

Maintenance.

It is surprising to note the number of appliances sold, but not in use. This is due to causes such as blown-out fuses, burned-off cords, lack of facilities permitting of the easy use of appliances, and the like. A very large number of appliances are not in use today because it is easier to go back to the old method than to have a cord repaired or a new fuse put in. Probably a still larger percentage is lying idle because of the fact, that in order to use them, it is necessary to take out a lamp or climb up on a chair to make the connection.

It should be the duty of each salesman on each of his periodical visits to see that every appliance is in working order. Each customer should be induced to install the necessary outlets for the flatiron, toaster, vacuum cleaner, etc. An addressed postal card should be left with the customer with which to notify the salesman of any trouble occurring between visits. This same method of following up and taking care of trouble will hold good for the commercial house and factory as well as the residence customer.

Financial.

For the proper merchandising of appliances, provision must be made to sell to the customer on the basis of a certain amount to be paid on the installation of the appliance, the balance in monthly installments with the bills for energy. No fixed rule can be made for this, but appliances costing $25 and under should be paid for in four months; $50 and under in six months; $80 and under in eight months, and $100 and under in ten or twelve months. Anything over $100 should be considered "special" and referred to the general sales manager.

The company should pursue a liberal policy of installing on trial, as it must be remembered that faith on the part of the company that its appliance will "stay put" will engender confidence in the customer, the public in the company. The value of this is fully realized. It is also evident that a solicitor who can satisfactorily fit into this scheme must be a high-class man. The salary must therefore be such as to attract high-class men. Conditions may vary in different localities, but with the foregoing as a basis almost any situation may be worked out.

For instance, some companies deem it advisable to work with the electric supply dealers. A system whereby the solicitor handles the dealers' appliances, the profit being divided between the dealer and the solicitor and the company, can be easily worked out.

That merchandising by this method can be made better than self supporting is evidenced by the experience of a large operating system which up to two years ago had been operating on the old "make and break" method. This company operates a chain of central stations. In 1914 it determined upon a policy such as hereinbefore set forth. The success that followed the change in policy was enjoyed by practically every one of its properties.

As an example of this success the experience of one of the central stations comprising this group may be cited. It operates in a city of about 200,000 people. Two years ago its monthly sales amounted to between $3,000 and $4,000 per month. Its new-business department was far from self supporting, the number of solicitors were comparatively few and their efforts were confined to low-priced appliances.

This company now employs 32 solicitors, the city is completely surveyed and blocked out in sections and each customer is called upon once a month. The appliances sold include every article from lamps to electric stoves, signs, etc. All articles are sold at list prices.

Charged against this department are the rent, heat, light of the space occupied by it, together with all other overhead expenses. During the first five months of the year the sales from appliances, lamps, signs and industrial appliances averaged $20,000 per month, as compared with between $3,000 and $4,000 of two years ago.

In addition to this department being now on better than a self-supporting basis, it is paying its solicitors a certain salary per month, in addition to commission, in return for which the solicitors maintain the appliances installed. This expense is taken care of by the profit derived from the sale of appliances to the benefit of the service department.

In view of the foregoing, it is certain that merchandising electric appliances can be placed on a profitable basis.

Persistent House-Wiring Campaign in Rockford Produces Excellent Results.

At the beginnnig of this year the Rockford Electric Company inaugurated a house-wiring campaign in Rockford, Ill., which has now been carried on continuously for six months and will be prolonged to the end of the year. Before opening the campaign it was felt by this enterprising central-station company that although the percentage of houses served was already higher in Rockford than in a great many other cities of its size (population now over 54,000), the condition was far from the point of saturation. It was therefore determined to make special efforts throughout the year to exceed all previous annual totals in house wiring.

The results at the end of the first half of the year show that the wisdom and energy used in conducting the campaign have been effective in greatly exceeding expectations. During these six months about three times as many houses have been connected along existing lines as in the corresponding period last year and for several months from 110 to 130 service connections have been made each month. These are practically all old houses just wired in accordance with the special offers of the campaign. As yet but few new houses have been completed this season; these, of course, are wired as they are built.

The secret of the success of the campaign lies largely in the persistency with which it is being conducted. Newspaper advertising is carried on continuously. Space is used every evening in at least one of the local newspapers, the advertising being usually alternated among them on successive days. The weeklies are also used. The advertising copy is frequently changed so as to make both a new and renewed impression. Each month a special electrical bargain circular is mailed to practically all residents not customers of the central station. The city directory is used as a mailing list, after having struck off all the names of customers. These circulars go out about the middle of each month, because this time has been found to give more favorable results than near the first of the

month, when the inrush of monthly bills of all kinds causes scant consideration to be given to further invitations to spend money. New copy, with slightly changed special wiring offers, is used each month. Special appeal is made to the women, showing how electricity will remove the drudgery from housework and increase home comforts. The June circular contained six special offers, as follows:

No. 1.—White enamel cabinet board, solid brass fixture, 60-watt Mazda lamp, iron or toaster outlet, a six-pound electric flatiron—all complete and installed for $3, the price of the iron. This offer is open to home owners only and is in the nature of an entering wedge.

No. 2.—Service entrance in basement, meter board with cutouts and switch, iron outlet in kitchen, cellar light with switch at head of stairs, a six-pound flatiron—completely installed for $13, or $1 down and $1 per month. This wiring is intended as an introduction to subsequent complete wiring of the house.

No. 3.—Service entrance in basement, meter and service board, iron outlet in kitchen, solid brass center fixture in dining room, flatiron, toaster—complete for $13.55, or $1.55 down and $1 per month. This is an introductory offer of wiring for dining room and kitchen and may later be completed throughout the house.

No. 4.—Wiring for five-room house, including parlor, dining room, kitchen, two bedrooms and bath; all wiring and fixtures, service connections, etc., completely installed for $25, or $1 down and $1 per month.

No. 5.—Wiring for six-room house. Similar to No. 4, but also includes an additional large room. Completely installed for $29, or $1 down and $1.25 per month.

No. 6.—Wiring for seven-room house. Similar to No. 5, but includes three bedrooms. All complete for $32.25, or $2.25 down and $1.25 per month.

In determining on the prices for the above six special offers and similar ones that are made from month to month, the central-station company conferred with the five leading electrical contractors in Rockford and the schedule of prices drawn up is one mutually satisfactory to all interests. All wiring is on the knob-and-tube or similar inexpensive but carefully installed system. The fixtures are simple but entirely serviceable.

The wiring jobs are distributed equitably among the contractors who have been found to do reliable work—an important consideration, because there is no electrical inspection in the city. These contractors have been so pleased with the volume and satisfactory character of the business secured that they have voluntarily contributed to the advertising fund so as to give still further publicity to the campaign.

A carefully devised follow-up system has been used by the central-station salesmen in their personal calls on prospects. Most of these calls are made in the evening when the head of the family is at home. Special prizes, such as flatiron, are given to customers who bring new customers on the lines. The campaign has interested tenants as well as house owners. A co-operative plan has been worked out whereby the tenant agrees to pay 50 cents a month more rental on condition that the owner has the premises wired. This increased rental practically pays for the wiring in a few years and has been effective in closing many contracts for complete electrical installations.

Along with this persistent house-wiring campaign have been carried on special sales of electrical appliances from time to time, particularly of flatirons and other fairly heavy current-consuming devices. Although these are designated as special sales, due to special efforts made to bring them to the notice of customers, they have not been made at reduced prices. It has been found that special price reductions create hard feelings after the special sale has ended and therefore tend to impede a continued campaign. During April about 500 appliances were sold; these included several ranges and washers. It has been found that special emphasis on the convenience and labor-saving features of electrical appliances is an important aid in making the house-wiring campaign attractive and at the same time makes the load from the houses connected much more worth while than if lighting alone were supplied.

St. Louis Company Reaches 70,000 Customers and Reduces Rates.

On June 1, the number of customers served by the Union Electric Light & Power Company, St. Louis, Mo., reached the imposing figure of 70,000. Coincidently, the company's rates were reduced one-half cent, the primary rate being reduced from 9 cents to 8.5 cents per kilowatt-hour, the secondary rate from 6.5 to 6 cents and the tertiary rate from 3.5 to 3 cents per kilowatt-hour. There is a discount of five per cent for prompt payment.

On January 1, 1916, the company had 65,000 customers and it announced at that time that when the figure of 70,000 had been reached a further reduction would be made. The plan of offering to reduce rates in proportion to the number of customers obtained is one which the Union Electric Light & Power Company has found to be productive of excellent results. All existing customers are vitally interested in helping increase the number of customers so that their bills may be lowered.

In announcing the reduction on June 1, the company offers to again reduce its rate when 5,000 additional customers have been secured. This is expected to be by December 1, 1916. The company in a half-page newspaper advertisement says: "The average yearly bill for 1915 of our residence customers, including lamp renewals, was $19.89, or about five cents per day (the price of a cigar or a shine).

"The average yearly bill for 1915 of all our customers, light and power, was $56.25, or about 15 cents per day.

"The average rate our company received in 1915 from all customers was 3.7 cents per kilowatt-hour.

"The 'Union Electric' renders most service for every dollar it receives."

Daylight Lamps Produce Good Show-Window Effects.

In some half-dozen stores in Rockford, Ill., the use of blue-bulb gas-filled tungsten lamps (Mazda type C-2) has been introduced in the display windows with exceptionally good results. The goods displayed are shown in their true daylight colors, which is in marked contrast to the windows of adjoining stores where ordinary vacuum or plain gas-filled tungsten lamps are used, these producing a decidedly more yellow effect. The use of the new lamps has resulted favorably not only for the merchants in whose windows they are employed, but also for the central station, the Rockford Electric Company, since 150-watt type C-2 lamps replace 100-watt type C lamps.

Indianapolis Electric Range Campaign.

The Indianapolis (Ind.) Light & Heat Company is conducting a sales campaign on electric ranges under the direction of Mr. Deeds, the head of the advertising and publicity department. The sales thus far have been very satisfactory and only three-fourths of the orders could be filled. Mr. Deeds says that the strong talking points has been the economic side, together with the good service secured. For a given length of time the electric range costs one-third more than the gas range, but can do in eighteen minutes what the gas range does in thirty minutes, so in the long run is more economical.

POWER ENGINEERING

Problems Involving Motor Applications, Machine Characteristics, Power Sales Methods and Industrial Electric Heating

ELECTRICITY ON A DUCK FARM.

By J. L. Springer.

Electrical applications are penetrating everywhere. An example of a rather unlooked-for character may be found in the case of Tanglewood Duck Ranch, near New York City. In order to understand the advantages and operating convenience derived from the use of electric energy it will be well to know the problems and other conditions.

At this ranch some 20,000 or 25,000 ducks are raised for table use per year; there is besides a fair-sized egg business. The salable age for a duck is 8 or 10 weeks. Hatching begins about January 1, and continues for 8 or 9 months. Here we have a divergence from approved practice in chicken raising—the chicken-hatching season being only about three months long.

A duck egg requires four weeks for incubation. During this period, the eggs in the hatching trays must be turned twice daily. The object is largely to bring the cooler part of the egg into the warmer region above, but also no doubt to offset the continual pull of gravitation in one direction. The incubator plant, which has a total capacity of 9,600 eggs, is accordingly equipped with individual electric lamps distributed one to each hatching compartment. These numerous lamps constitute, at Tanglewood, a separate system from the lamps which furnish the incubator room with its general lighting. The compartment lamps are operated on a 10-volt circuit, thus largely eliminating danger and satisfying the underwriters. These 10-volt lamps are operated from a current transformer from the 110-volt circuit which supplies the general lighting system.

All energy is received from the local central station, transmitted at 2,200 volts. This is 60-cycle, alternating current, which is transformed by the power company's transformers either to 110 or 220 volts.

There are a number of such transformers scattered about the place. There are three searchlights each operated on a 10-volt circuit. These are 30-watt tungsten lamps. They are so located that when lighted the whole area occupied by adult ducks may be illuminated. All may be operated from any one of three points—the owners' house, the superintendent's house and the watchman's house. They serve more than one purpose, as they may be used in case of burglar alarm; and are serviceable also to cut short "racing." Racing is the disturbance consequent upon fright—starting, it may be, from the sudden alarm of but a few ducks. It may be brought about by the fluttering of a piece of paper. It may involve the whole company of adult ducks. When a duck is seriously alarmed at night, it runs, or races, for the water, where it probably feels itself more at home. It is important to stop the panic, and a flood of light is the thing with which to do it.

In addition to the searchlights, there are 60-watt lamps secured to goosenecks distrbuted over the farm. These are on the 110-volt circuit. All may be thrown on or off from any one of several points. It will be seen then that Tanglewood may upon occasion be very brilliantly lighted.

General View of a Duck Farm Where Electricity Is Used Throughout

Electric lights on the 110-volt circuit are used in the dwelling houses, in the brooder houses and elsewhere.

Electricity for Egg Candling.

There is one other service performed by electric light. This is in connection with the testing of eggs. When the eggs go into the incubator, it is not known which are fertile and which

Motor Driving Feed Grinder on Duck Farm.

are infertile. It is desirable to eliminate the infertile ones as soon as possible, so that their places may be taken by hatchable eggs. When the eggs have been subjected to the incubator heat for about one week, the separation is possible. If a fairly strong light be passed through an egg which is otherwise in the dark, one or other of three conditions will ordinarily be disclosed. First, a group of veins radiating from a central nucleus may be observed. The egg showing this is fertile and may reasonably be expected to yield a duck at the end of the three weeks additional in the incubator. Second, a black speck without radial arms may appear. This condition is supposed to indicate that there was once promise of fertility; but that the egg is now useless for hatching purposes or for any other. Third, the egg will disclose only a clear lighted surface. The egg is probably infertile, and it is not to be expected that a duck will come from it. It is, however, of value for baker's use. They sell for something like one-half or two-thirds the price of ordinary eggs. A number of methods are in use in connection with the elimination of useless eggs. Apparently, only one of these has the indorsement of Tanglewood. Thus, the device is objected to which is used to some extent by egg candlers and which carries the eggs one by one past an illuminated point. The objection from the incubator point of view—though perhaps not from the egg candler's—is that fertile eggs may be carried by undetected, because of the radial structure being in an unusual part of the egg. The duck producer does not want to lose the duck 25 per cent hatched. Another method objected to by Tanglewood is that which provides for the quick, simultaneous inspection of a considerable number of eggs by bringing a single layer of them over a glass lighted from below. A tray with textile or wire netting for the bottom may be used. The entire group is viewed almost at one moment, and the various classes separated. No doubt the device operates with a fairly high degree of certainty. But Tanglewood thinks it will permit some fertile eggs to pass unnoticed. The tester used is a simple wooden tube, square in cross-section, and partially closed at either end. This is set up on one end, and is provided with an opening of the general form of an egg, but somewhat smaller than an ordinary one. An electric lamp is put within on one side at such a level as to throw its light squarely through the egg, when the latter is held against the hole. Testing goes on in a dark room. The tester should not permit light to issue from cracks and crevices. The openings at top and bottom are simply for ventilation. If the egg appears clear, the operator may shift its position in order to make sure it is not fertile.

Power Applications.

The use of energy for power purposes at Tanglewood is one of the principal reasons for the very decided reduction effected in operating expenses. It seems that ordinarily the duck producers are using the gasoline engine. Ten thousand ducks of all ages require all varieties of food and lots of it. Adult ducks are fed from three to five times a day. Younger ducks may require food oftener. About 20 bushels of green stuff are cut up in a power cutter twice a day. This is mingled with other food, such as meal, and water to form a wet mash. This other material will differ in relative quantity and also in its character in accordance with the age of the ducks to which it is to be fed. Accordingly, the power mixer must be run for a variety of batches. The food question, it will be seen, brings about an intermittent demand for power. The total number of kilowatt-hours actually used are insignificant.

Motor-Driven Pumps Used.

The water supply of a poultry ranch is quite important. On a duck farm like that at Tanglewood, where the adults are on a water front, the drinking-water requirements are confined mostly to three brooder houses—one warm house and two cold ones. These have watering troughs in the "front yards" belonging to the several brooding houses. A certain amount of water is also required for mixing the wet mash, and for ordinary purposes around the place. Altogether, there is need for considerable water. There are three pumping plants. One is a windmill; the others are electric driven, one being operated by the motor which drives the cutter and the mixer, the other by a separate motor at the owners' house. Pressure for the water is obtained either from the elevated tank at the windmill or from air-compression tanks at the house of the owners. The windmill and both motors may put water either in the windmill tank or in the compression tanks. The motor at the house comes automatically into operation whenever pressure in the compression tanks falls below a pre-determined minimum or whenever the water in the windmill tank falls below a certain level. The windmill tank has the advantage that the pressure never drops below the minimum determined by the elevation of its bottom; the compression tanks, that they are not subject to freezing.

Model Chair Factory Uses Central-Station Service.

The Milne chair factory recently placed in operation at Chattanooga, Tenn., represents the latest development in chair-factory work in the South and marks an advancement in woodworking plants in Chattanooga. It is so located that it has two railroad connections, facilitating shipments, and has three spur tracks built into the warehouse and kilns.

In building this factory, the question of efficiency was first considered. Work and material have been so arranged that no matter what the output is, the factory will be operated at approximately maximum efficiency. The unloading sheds for lumber are so arranged that material is unloaded directly from the cars to small lumber carts and tracks are so provided from each shed that lumber can be handled directly from the sheds to any one of the eight kilns. The facilities for this are arranged carefully to meet different conditions. From the kilns the lumber can be handled directly to the plant from the same cars, or directly to a special shed that is also steam heated to prevent the lumber from taking up any further moisture.

Lumber is taken into the factory at the rear end and as operations are completed, they work forward on the three machine floors and on into the assembling and finishing departments; machinery being arranged on three floors.

This factory also represents the most efficient method

of drive for woodworking plants. After investigating a number of factories in the North and East, it was decided to equip each and every machine with a separate motor, which eliminates any power losses due to belting, etc., and also maintains a constant speed on each machine so that the output is uniform throughout. This will likewise make an enormous saving in power consumption.

There is a very complete blower system installed for handling shavings, all shavings being handled directly from every machine to the cyclone above the boiler house. There are installed two boilers of sufficient capacity to take care of all the kilns and all the heating.

The factory is operating off of one of the local power companies, which ran its 6,600-volt line to the plant, stepping the voltage down to 220 volts. The power company's line was built in ample time to install saws and elevators for building purposes and this alone is an asset in building, obtaining cheap and reliable power for building operations.

Even though this is a woodworking plant, it has been decided that it will be practical to use only shavings under the boilers and dispose of all blocks and small lumber as kindling and fire wood which will be much cheaper than burning same. It is expected that revenue from sale of this wood will practically pay for the power purchased from the power company.

The power company's lines run directly to a main switchboard located in a special switching room, which board is a five-section, 220-volt, three-phase, 60-cycle panel equipped to take care of 660 horsepower total capacity. From this board is distributed power through three main circuits to three different sections of the plant, and also from this board the voltage is stepped down to 110 volts and the lighting circuits are taken care of from this central point. There is approximately 660 horsepower in induction motors installed; all of them being constant-speed, three-phase, 60-cycle, 220-volt motors, with the exception of one multi-speed motor on a special lathe. The total number of motors is about 110; averaging about six horsepower per motor. The largest individual motor installed is a 60-horsepower motor to operate the blower system.

From a woodworking standpoint, this plant solves a number of interesting problems, and is of special interest in connection with the methods of adapting motors to individual machines. For instance, there are installed approximately 15 one-horsepower vertical motors running small drills and practically every drive is a special drive for chair machinery.

This factory has ample fire protection, having direct connection to the city water mains, a large fire pump which can be operated from the reservoir and also has installed a water tank above the building at considerable height which is of sufficient capacity to take care of the sprinkler system for a considerable length of time. The different sections of the factory are arranged to be cut off by automatically operated fire doors, thereby reducing risk of fire to a minimum.

SINGLE AND DOUBLE-PLY BELTS COMPARED FOR MOTOR DRIVE.

By W. F. Schaphorst.

Double belts cost twice as much as single belts of the same width. But, they do not transmit twice as much power as single belts. Naturally this gives the single belt the advantage in a great many cases as it justly should. Yet, I have never known this cost relation to be considered in the selection of a belt drive for a given purpose.

Usually the designer looks over his plans, and if it "seems" that a double belt should be used he specifies such a belt without first making comparative computations. If the power to be transmitted is small, if the drive is unimportant, and if costs must be as low as possible, the designer usually "guesses" that a single thickness belt will be "good enough."

To illustrate the point and thereby make it more emphatic, let me take a simple case where 50 horsepower is to be transmitted from a 4-foot pulley to another 4-foot pulley, the distance between shaft centers being 30 feet. I am a believer in large pulleys, in most cases, and in high belt speeds. Large pulleys do not slip so easily, are often more economical because they permit the use of narrower belts, and the pulling stress on the shafting is correspondingly less. So, all in all, large pulleys and high belt speeds generally make the most efficient and most economical combination. We will therefore use a belt speed of a mile a minute, which is permissible with good cast-iron pulleys.

At that speed each inch in width of single belt will transmit $5,280 \div 800 = 6.6$ horsepower.

And each inch in width of double belt will transmit

$$5,280 \div 500 = 10.56 \text{ horsepower.}$$

From this we find that the single belt will have to be $50 \div 6.6$ or 8 inches wide, and the double belt $50 \div 10.56$ or 5 inches wide. These will require 9-inch and 6-inch pulleys respectively. The costs of these pulleys to the trade at normal prices are $14.60 and $13.30, respectively for one, or $29.20 and $26.60 for the pair. The pulleys for the single belt will therefore cost $29.20—$26.60 or $2.60 more, which is not very much, considering the size of the drive. This will be more than counterbalanced by the money saved through using a single belt instead of a double belt.

In this case it is clear that the length of belt will be $(2 \times 30) + 4$ or 72.5 feet. Now, since all belting catalogs give prices on belts per foot for all standard widths, we can easily arrive at the costs of our own belts. I find that the single belt will cost $62.30; the double belt $78.40. The double belt will thus cost $78.40—$62.30 or $16.10 more.

The overall saving through use of the single belt will therefore be $16.10—$2.60 or $13.50, which is certainly large enough to be considered.

It is evident that the greater the distance is between shaft centers, the greater is the saving with single belts. But where the distance is small the difference in cost is slight and at certain distances in any drive the costs will be equal mathematically. Practically, though, such distances are often impossible, as in the example just cited where I get a distance of —0.4 foot as the distance at which costs would be equal. I do not know how such an arrangement would look, nor does anybody else, for I have never seen shafts set at a "negative distance" apart. I get a negative result here because the excess cost of the double belt in merely wrapping around the 4-foot pulley would alone be more than $2.60, the pulley saving.

The double-thickness belt has an advantage where space is expensive, of course. Very often a single belt might cause additional expenditures due to its greater width, in which case such expense must be considered. It would hardly be good practice, for instance, to use a wide single belt for the sake of economy and at the same time make the sheltering building a foot or so longer just to house the belt. Usually, however, we are not so cramped for space, and we can use either a double or single belt or we can use a three-ply belt, if our judgment and computations will tell us to do so.

All of these little things should always be considered, especially where a large number of belts and pulleys are used. Good single-thickness belts give excellent service where they are properly cared for. Double belts need not be used simply because it "sounds" better to say to visitors, "Our drives are all equipped with double and triple-ply belts. We haven't a single-ply belt in the house."

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

SUGGESTIONS FOR THE USE OF FLEXIBLE CORD IN WIRING.

By Terrell Croft.

Flexible cord is, necessarily, no matter how well it may be insulated, of rather delicate construction. The bending of the cord due to its continued movement may break the small wires which comprise the stranded conductor within. Then these sharp ends work through the insulation and possibly into contact with the strands of the conductor of opposite polarity, causing a short-circuit. The insulation may ignite and a fire result. Hence, flexible cord should be used only when more substantial conductors cannot be utilized. The two conductors of opposite polarity in a flexible cord lie very close together, rendering unusual precautions necessary. To sum the matter, it may be stated that flexible cord is a very undesirable material from a fire-hazard standpoint, but it seems to be a necessary material, so that its use, subject to certain restrictions, must be sanctioned.

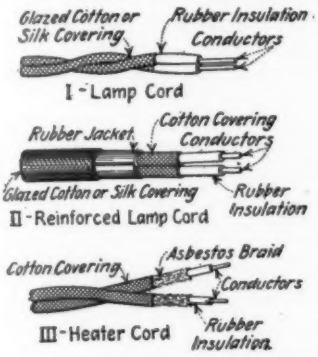


Fig. 1.—Principal Different Kinds of Flexible Cord.

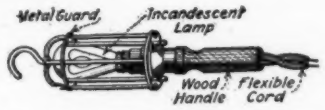


Fig. 2.—Metal Guard for Protection of Portable Lamp.

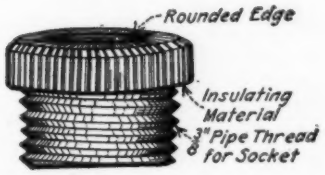


Fig. 3.—Three-Eighths-Inch Socket Bushing.

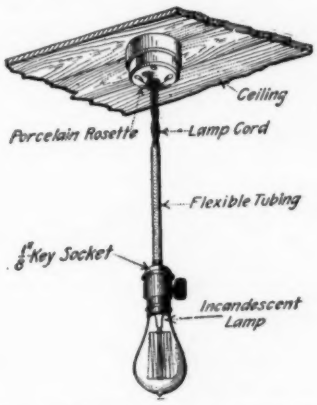


Fig. 4.—Flexible Tubing Protection for Lamp Cord.

Flexible cords having different types of insulation and of different constructions are made for different services. The matter of the construction of these different sorts of cords is covered very fully in Code rule 51.

The three principal types of flexible cord are (Fig. 1):

(1) Drop or lamp cord. This consists of a pair of insulated stranded wires twisted together. Each wire has a serving of cotton thread and is then coated with rubber insulation and given a woven cotton serving for mechanical protection. Two such conductors are twisted together. A cord of this construction is used only for short pendants in dry places hanging freely in air.

(2) Reinforced or portable cord. This consists of a cord made like the drop cord described above except that in addition it has molded over the two twisted conductors an additional coating of rubber and then over this is served (for mechanical protection) a strong cotton braid. A cord of this character is used for portable lamps or wherever the cord is subject to much usage.

(3) Heater cord, instead of having a rubber insulation, has one of a non-combustible, heat-resisting material, usually woven asbestos. Over this, as a mechanical protection, is served cotton braid.

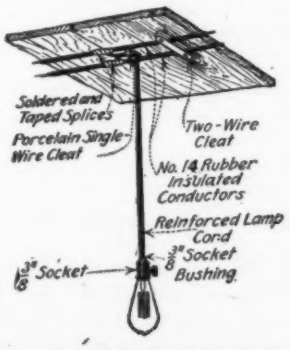


Fig. 5.—Best Manner of Installing a Pendent Lamp.

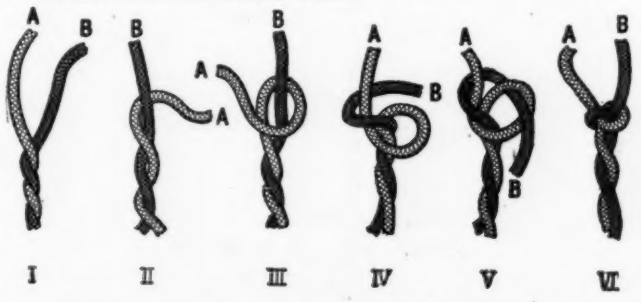


Fig. 6.—Successive Steps in Method of Tying the So-Called "Underwriter's Knot."

A number of special types of cord, such as packing-house cord, brewery cord, stage cable and the like, are manufactured.

The sizes of flexible cords vary with the service required. The ordinary drop cord is composed of two conductors, each equivalent to a No. 18, 16 or 14 B. & S. gauge solid wire. The smallest flexible-cord conductor permitted is No. 18.

Flexible cord should not be used as a support for fixtures because it has not sufficient tensile strength to sustain any great amount of weight.

Long pendants with adjusters should be avoided. The adjusters are liable to injure the insulation. If a long drop-cord pendant is provided and then an adjuster supplied on it so that its effective length can be shortened,

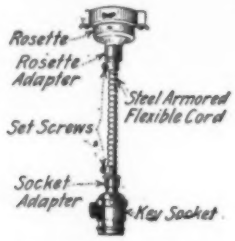


Fig. 7.—Metal-Armored Lamp Cord.

the tendency is to use the lamp on the cord as a portable lamp. Pendants of ordinary flexible cord should always hang free in air. Flexible cord should never be run along walls or ceiling either supported by insulation or otherwise and should never be used where No. 14 wire can be made to serve.

The best method of installing a pendent or portable lamp is shown in Fig. 5. Reinforced lamp cord supported at the ceiling with a single-wire cleat and terminating in a properly bushed three-eighths-inch socket should be used. The conductors of the cord should each be soldered to one of the circuit wires and the joints thoroughly taped.

For portable lamps, that is, for those lamps the cords of which may not always hang freely in air, reinforced cord should always be used. The reason is that the ordinary flexible cord, Fig. 1, does not have sufficient insulation and mechanical protection to insure its integrity if it is subjected to the usage ordinarily encountered by a cord which is not always held freely in air.

Portable lamps should have protective guards as shown in Fig. 2, to insure against the breakage of the lamp and the fire risk involved thereby. The guard should be of such construction—should have a close mesh—so that

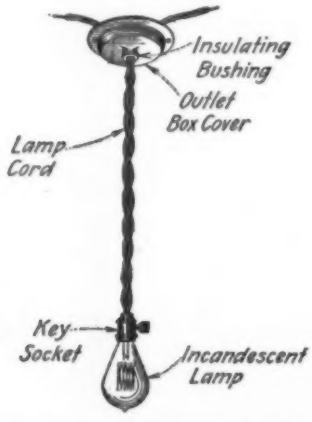


Fig. 8.—Insulating Bushing Protecting Flexible Cord Where It Passes Through Box Cover.

things outside of it are not liable to touch the glass bulb of the lamp.

Metal-armored lamp cord should always be used in show windows (Fig. 7) because a large number of fires have been caused through the application of unarmored cord in these locations. Experience has shown that things are hung on lamp cords in windows and even pinned to them. As suggested in the illustration, steel-armored flexible cord is attached to the socket by means of a socket adapter and to the rosette or outlet box above with a similar device.

Insulating bushings should be used in every socket unless, by reason of the construction of the socket, the conductors entering it are adequately protected from abrasion. Threads in the holes in ordinary sockets present knife-edge corners which will, unless bushings are used, rapidly cut through the insulation on a cord and possibly cause a short-circuit. A composition insulating bushing for a three-eighths-inch socket is shown in Fig. 3.

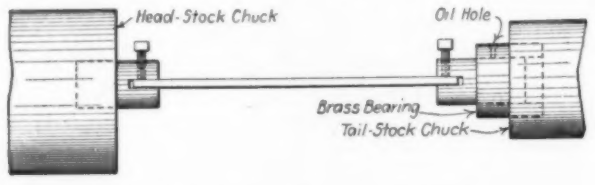
Cords should be so arranged that they impose no stress upon binding posts or connectors. This provision is usually satisfied by tying suitable knots (Fig. 6) in the ends of the cord, so that any stress imposed will be assumed by the knot bearing against some rugged part of the fitting. The installer should be certain that the knot does bear against the porcelain or metal of the fitting and thus relieves the terminals of strain. Special fastening devices for flexible cords are supplied in sockets and fittings of certain makes.

Where a flexible cord passes through an outlet-box cover it must be protected against abrasion and contact therewith by a bushing, as shown in Fig. 8. Porcelain bushings, specially made for the purpose and so arranged that they can be substantially fixed in the cover, are the best for this service. However, ordinary composition bushings may be approved for this service by some inspectors if, after the bushing is inserted in the hole, it is heated with a match until plastic and then formed over at the side of the cover so that it cannot fall out. The metal of an outlet box cover is so thin that the few threads that can be cut in it are not sufficient to hold substantially the ordinary composition bushing like that of Fig. 3. Furthermore, these composition bushings are so brittle that they break frequently.

Cord in places where it is liable to become saturated with oil, as in machine shops or factories where the key sockets are operated by men with oily hands, may be protected by flexible tubing as shown in Fig. 4.

Holder for Rewinding Flat Resistance Units.

When removing burnt-out resistance units that are wound on flat strips of insulated brass or iron, considerable trouble is frequently experienced in holding the strip in the lathe chuck. To meet this condition, a holder shown



Simple Holder for Winding Resistances.

in the accompanying sketch was made by sawing a slot in two pieces of three-quarter-inch round rod and putting a set-screw in each piece, as shown. A third piece forms a bearing for the tail-stock end and is also held in a chuck or by some convenient means. The wire can be quickly run on by wrapping it around a piece of hard wood held in the tool post, and setting the lathe gears in the same way as to cut a thread with a pitch equal to the pitch of the winding.

R. L. Hervey.

The Pennsylvania Board of Public Grounds and Buildings has awarded the contract for the erection of a new power house at Polk (Pa.) Institute to C. F. Hamilton at $33,217. The contract for the electrical work has been awarded to the Meadville Electric Company, of Meadville, Pa.

Alternating-Current Motor Windings—III

By Justin Lebovici

This is the third installment of a series of articles dealing with the windings of alternating-current motors. The present article deals with wave and lattice connections. Subsequent articles will discuss skein windings, polyphase windings of open and closed types, mechanical construction of windings, etc.

Wave Connections.

Should the elements in conductor diagram Fig. 29 be heavy bars then it may be advisable to connect the same according Fig. 38, which constitutes a wave winding. The bars can be all of equal length and the end connections can be arranged as shown in Fig. 39. Fig. 40 shows the detail drawing of an

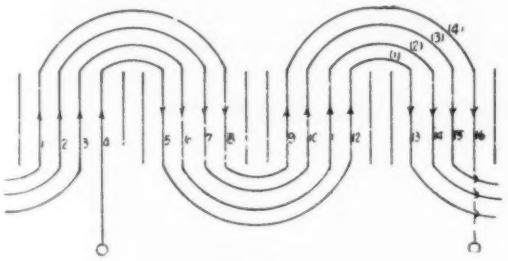


Fig. 38.

end connector. There are four different shapes of end connectors (1) (2) (3) (4) (see Fig. 39).

Fig. 41 shows another form of wave winding which can be obtained by cross-connecting Fig. 29.

The advantage of this winding connection consists in having all end connectors of the same shape. The end connectors *CDE* can be formed from the strip shown in Fig. 42 by bend-

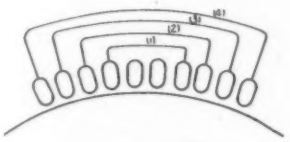


Fig. 39.

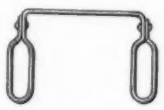


Fig. 40.

ing the same to the involute shown in the same figure. The bars 9 and 13 are of different length as shown in Fig. 43.

In order to obtain a more even distribution of the end connections we can connect conductor diagram Fig. 29 to the winding shown in Fig. 44, in which we move around the winding in one direction until we have connected half the number of conductors; then we reverse and connect the rest of the conductors moving from bar to bar in the opposite direction.

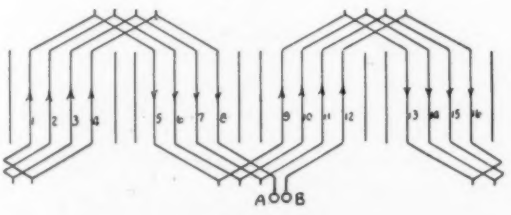


Fig. 41.

The part of the end connectors shown in full lines are in a different vertical plane than the part shown in dotted lines, the end connectors being U-shaped pieces, same as used in connection with Fig. 40.

Lattice Connections.

This form of end connection is very commonly used in industrial motor sizes because all coils composing the winding are alike and can be easily formed.

Starting again from the conductor diagram Fig. 29 and using a throw of coil y_1 equal to a pole pitch τ we obtain the connection diagram and winding shown in Fig. 45.

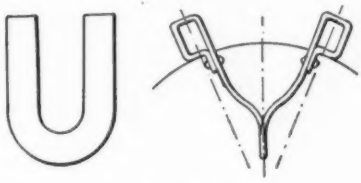


Fig. 42.

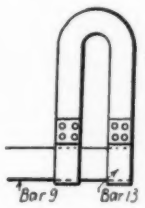


Fig. 43.

Shorter winding heads would be obtained if the throw or pitch of the coil y_1 is made shorter than the pole pitch τ, as shown in Fig. 46.

The winding potential diagram for the connection diagrams shown in Figs. 30, 31, 38, 41, 44 and 45 leads to the same resultant voltage, for all are based on the same conductor dia-

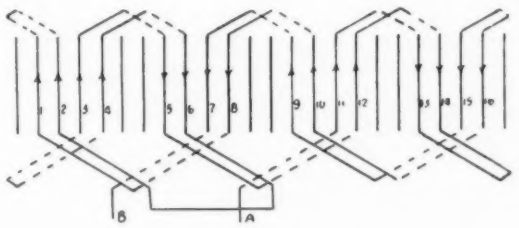


Fig. 44.

gram shown in Fig. 20. The resultant voltage is given by line *AC* in Fig. 37.

The windings shown were all one-layer or single-layer windings. The lattice connections are more often used in connection with two-layer windings or coils and the most common type of winding for this purpose is that of the diamond shape which is shown in Figs. 15 and 17.

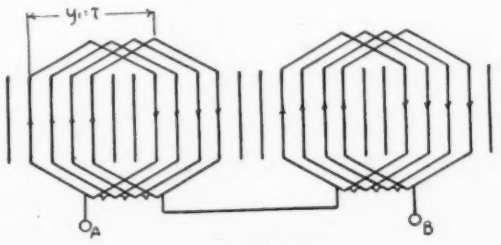


Fig. 45.

Assume the six-pole conductor diagram with four slots per pole, of which two are wound. The coils may be diamond shaped, the two sides of the coils lying in different planes, forming a two-layer coil. There are two coil sides in each slot.

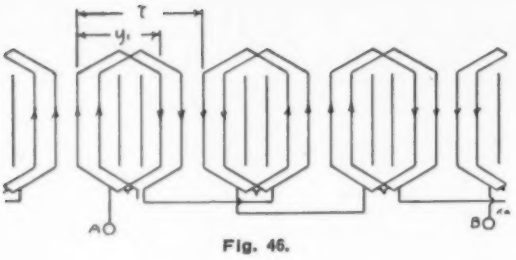


Fig. 46.

Fig. 47.

The coil side or conductor lying nearer to the bottom of the slot is shown by a dotted line, the conductor lying nearer the top of the slot is shown by a full line.

The conductor diagram, Fig. 47, can also be represented by conductor diagram, Fig. 48, the slot outline being usually omitted.

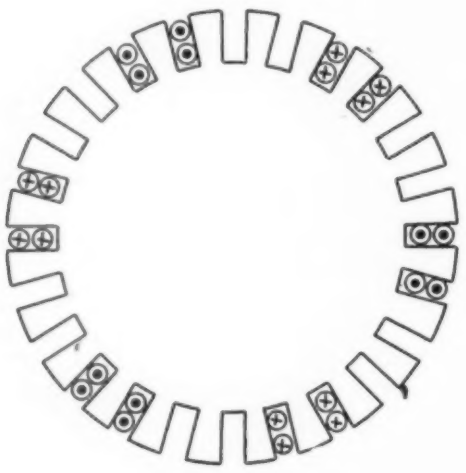


Fig. 48.

Figs. 49 and 50 represent the connection diagrams using the two-conductor diagram illustrations shown in Figs. 48 and 47 respectively. The windings shown are lap windings and are identical except for the way the conductors are shown.

The arrows *a, b, c, d, e, f* in Fig. 50 indicate the direction of flow of current in the connections between the coils and in the

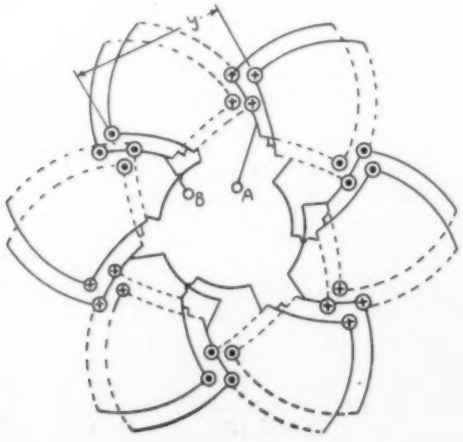


Fig. 49.

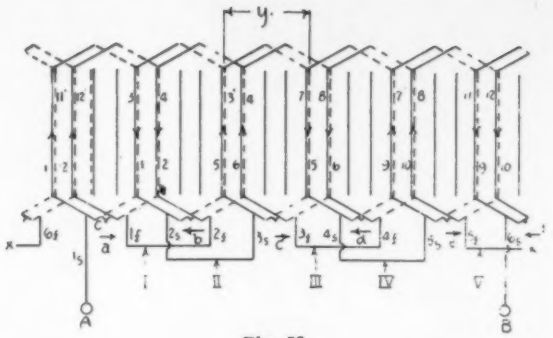


Fig. 50.

coil ends and lead to another very convenient mode of representing winding diagrams.

The two coils 1, 1′ and 2, 2′ in Fig. 50, together with the connection between coils *c* and the two leads 1_s and 1_f form a

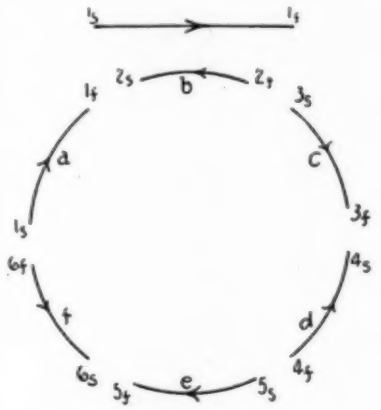


Fig. 51.

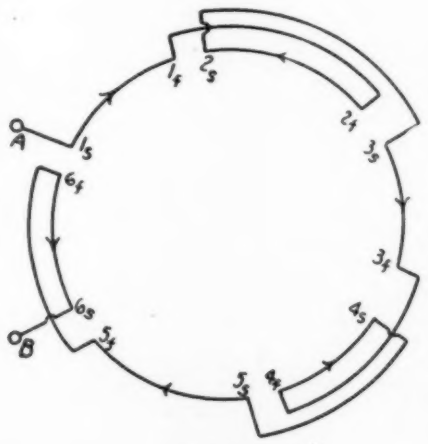


Fig. 52.

coil group, there being as many coil groups as there are poles (in Fig. 47 there are six groups). The coil group in Fig. 47, starting with lead 1_s comprising coils 1, 1′, cross connection *c*, coil 2, 2′ and finishing with lead 1_f, can be represented by a single line as shown in Fig. 51.

The groups making up winding diagram Fig. 50, are also

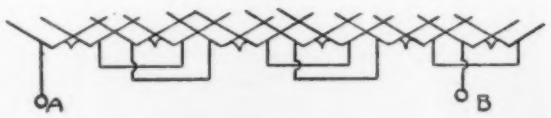


Fig. 53.

Fig. 54.

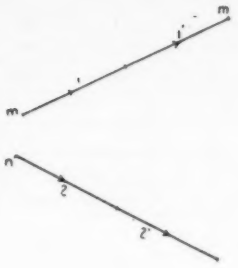


Fig. 55.

shown in Fig. 51, the groups *a, b, c, d, e, f* being arranged in a circle.

Adding the cross connections I, II, III, IV, V from Fig. 50 to Fig. 51, we obtain the entire winding diagram Fig. 52. The only additional information the winder would need in order to cross-connect the machine would be a statement as to the number of coils per group, in our case two coils per group.

In place of the winding diagram, Fig. 52, sometimes the winder gets only a table containing the information given in the diagram. Such a table is the following and it conveys the information given in Fig. 52:

Ao—1s—1f—2f—2s—3s—3f— 4f—4s—5s—5f—6f—6s—oB

The sign ⌒ indicates the cross-connections I, II, III, etc., in Fig. 50.

Such a table, together with a memorandum giving the number of groups, as well as the number of coils per group, is all the information the winder needs to connect up a winding.

Since the coils are symmetrically placed in slots around the stator or armature in some shops, it is usual to omit from diagram Fig. 50 the arrangement of the coils in the slot and only indicate the end connections and cross-connections.

Winding diagram Fig. 50, modified in this way, is shown in

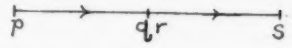


Fig. 58.

Fig. 53. This diagram is especially valuable in connection with polyphase winding diagrams, since the same diagram can be used for windings using coils of different coil pitch.

The winding potential diagram for the conductors 1, 2, 1′, 2′ under one pair of poles of Fig. 50 is given in Fig. 54. The line 1 represents the voltage generated in the conductor or con-

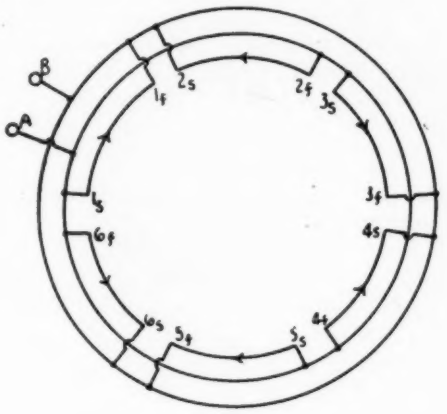


Fig. 61.

ductors filling one-half slot. Two or more wires connected in parallel are considered as one conductor. The voltages generated in coil 1, 1′ and coil 2, 2′ are given by lines *m m* and *n n* in Fig. 55. Since the line *m m* is parallel to the line 1 as in Fig. 54 and equal to twice 1, we can consider the line 1 representing *m m* or the voltage generated in one coil. This is true as long as the pitch of the coil 1, 1 equals the pole pitch. If the pitch of the coil differs from the pole pitch the line 1 is still proportional to the voltage per coil as will be shown

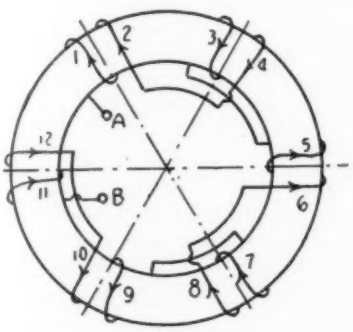


Fig. 56.

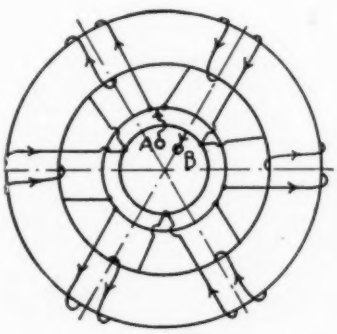


Fig. 59.

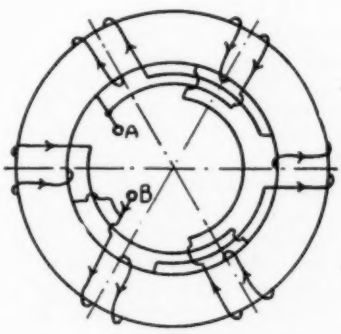


Fig. 60.

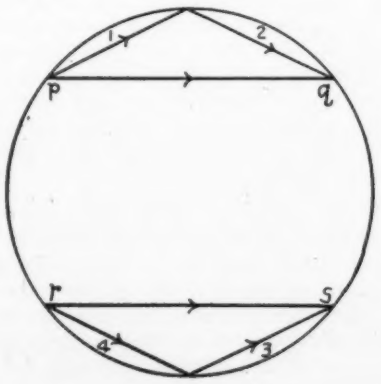


Fig. 57.

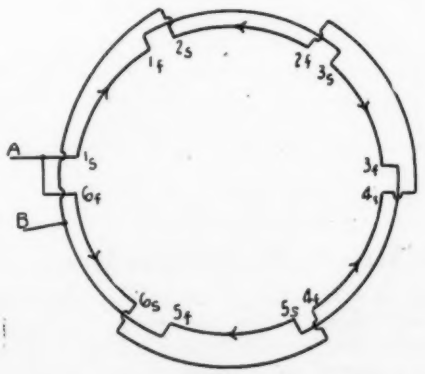


Fig. 62.

later. Considering 1 and 2 in Fig. 54 as the voltage per coil facilitates the problems connected with windings since we have to consider only the voltages induced in one side of the coil and makes the winding potential diagram of a drum winding identical with the diagram given in Figs. 26 and 27 for a ring winding.

The above considerations lead to the assumption that for the purpose of the potential diagram the entire voltage generated in the coil 1 1′ is generated in conductor 1; in other words the winding shown in Fig. 50 is equivalent to the ring winding shown in Fig. 56. The potential diagram for coils 1, 2, 3 and 4 under one pair of poles is given in Fig. 57.

The amplitude of the resulting voltage is given by the sum of *pq* and *rs*, where *pq* and *rs* in Fig. 58 are respectively equal and parallel to *pq* and *rs* in Fig. 57.

The winding shown in Fig. 50 or its diagrammatic equivalent Fig. 56 being symmetrical, the voltage under each of the other two pairs of poles will be the same as under the pair of poles considered in Fig. 57. All the coils being in series, the voltage between the terminals *AB* will be equal to three times the value *ps* shown in Fig. 58.

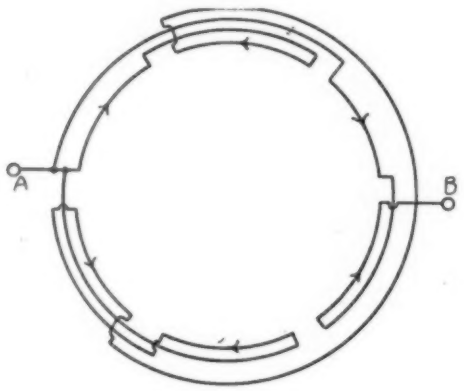


Fig. 63.

Instead of connecting the group of coils 1, 2 in series with group 3, 4 (see Figs. 56 and 57) we could have connected these groups in parallel; then the resultant voltage amplitude would have been equal to *pq*. We are now free to connect the windings of the other two pairs of poles in parallel or in series to the winding of the *first* pair. In the first case, we have winding diagram shown in Fig. 59, in the second the winding diagram shown in Fig. 60.

The amplitude of the resultant voltage between leads *AB* in Fig. 59 is equal to the value *pq* in Fig. 57. The amplitude of the resultant voltage between leads *AB* in Fig. 60 in equal to three times *pq*. The amplitude of the resultant voltage between leads *AB* in Fig. 56 is equal to six times *pq*.

Using the typical diagram representation shown in Fig. 51, diagram Fig. 56 would take the shape illustrated in Fig. 52. Diagram Fig. 59 would be indicated as shown by Fig. 61. Diagram Fig. 60 would be shown as illustrated in Fig. 62. The amplitude of *AB* in Fig. 63 equals twice *pq*.

Assuming that Fig. 52 represents the winding diagram of a 660-volt single-phase winding induction motor, then by changing the group connections only we could change the motor to a 220-volt machine by using connection diagram Fig. 63, to a 110-volt machine by using diagram Fig. 61, to a 330-volt machine by using Fig. 62.

(To be continued.)

Simple Tests for Single-Phase Motors.

A good way to test for short-circuits in the rotor of the type of single-phase motors that start as commutator motors and have the brushes thrown off and the commutator short-circuited when reaching full speed, such as the Wagner or Century makes, is to disconnect the motor from the apparatus it is driving, raise the brushes off the commutator, then close the switch which is used to start the motor. Now turn the rotor slowly by hand. Should there be any short-circuits in the rotor, it will have a tendency to stick opposite each pole. This tendency to stick will be quite pronounced and the rotor will turn with a decided jump as the defective coils pass the center of the pole. If the rotor turns freely, then the winding is clear.

To test the stator coils for short-circuits it is only necessary to raise the brushes off the commutator, close the switch, thus throwing the stator winding across the line. Leave the switch closed for a few minutes. If there should be a defective coil there will be an unusual heating in the defective coil or coils, whereas the sound coils will remain close to normal temperature.

F. A. Grohsmeyer.

Among the Contractors.

The Home Electric Construction Company, Macomb, Ill., is completing the electrical work in the new post office and a large new building in Beardstown, Ill. This enterprising contracting firm, of which W. I. Savidge is president and general manager, does considerable business in the adjoining towns of Beardstown, Rushville, Colchester and Bushnell. It also sells a general line of electrical appliances and supplies, stocks of which are kept in these different towns as well as at the home office.

The White City Electric Company, Chicago, Ill., has obtained the contract for the electrical work in the new addition to the Winnebago County Court House, Rockford, Ill. This structure was erected over 40 years ago and is now being enlarged by an addition which will cost about $250,000. A distinct feature of this addition will be that the county jail will be located on the fourth and fifth floors.

Joseph Sauer, Glen Elyn, Ill., has recently completed the electrical work on the Smith Block at Wheaton, Ill. This included a very complete electrical installation with two McWilliams metering boards and 24 meter loops. Another recent contract was the Lombard Public School, a large reinforced structure. The new Elmhurst Theater also has been wired by Mr. Sauer's firm. All of these jobs involved high-class conduit work.

The Central Electric Company of Peoria, Ill., of which L. B. Van Nuys is president and general manager, has recently completed the electrical work in the Havana High School, also the complete wiring of the Greenview Township School.

J. A. Portner, of Wheaton, Ill., has the electrical contract for three large residences that are of practically fireproof construction and which are being built adjoining the grounds of the Chicago Golf Club. These buildings were designed by and are owned by Jarvis Hunt, architect. The electrical equipment in them is exceptionally complete and up to date. This firm is also wiring two large residences being built for Judge Clark. A first-class conduit installation is going into each of these five residences.

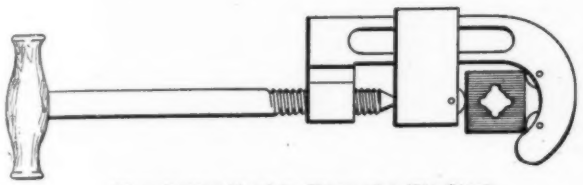
J. E. Mullen & Son, Savanna, Ill., are inauguratig a house-wiring campaign in co-operation with the Peoples Gas & Electric Company of that city. Mr. Mullen's firm has been doing the wiring for this central-station company for some time on mutually satisfactory terms. In the present campaign it is expected to offer the privilege of paying for the work in 12 monthly installments.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Pipe Cutter Used as a Die Stock.

Any electrician going on a small conduit job, such as running pipe for an entrance, etc., will find the scheme here described and shown a very handy one. It also saves carrying a separate die stock, which on such a job



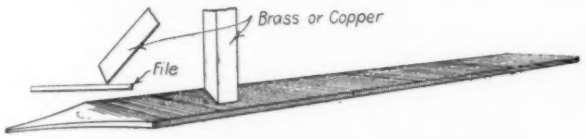
Pipe Cutter Used in Place of a Die Stock.

would be used very little. By tightening the cutters on the die it will hold the latter just as firmly as a regular die holder.

W. Morris.

Cleaning a File Without a File Card.

The accompanying sketch shows a simple method of cleaning a file without using a file card or brush. Take a piece of brass or copper which has a sharp corner on it,



Method of Cleaning a File Without Using a File Card.

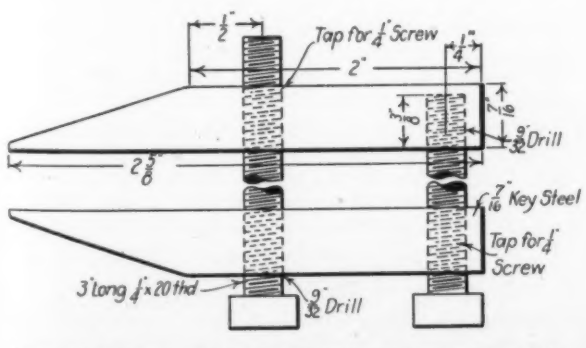
and rub on the file in the same direction as the cut of the file. The above will give better satisfaction than a brush, especially if the file has been used on lead or babbitt metal.

William A. J. Hahn.

Toolmaker's or Precision Clamp.

A simple form of toolmaker's clamp that is very convenient for an electrician to have available can be made as shown in the accompanying diagram. It is made from seven-sixteenths-inch square key steel, the two pieces of which are each about 2.625 inches long and tapering at one end as shown. These pieces are drilled and tapped for the clamping screws as shown. It is best to use a one-quarter-inch-20 round-head or filister-head machine screw. These screws should be about three inches long.

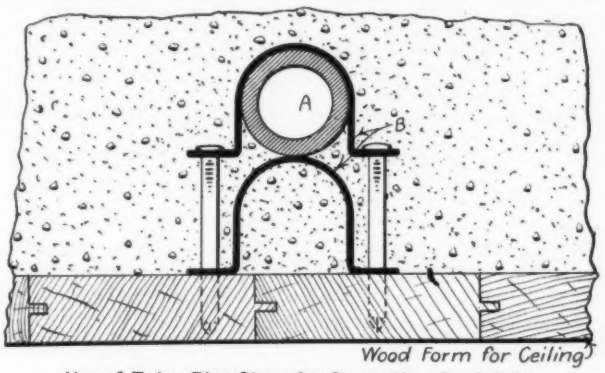
F. A. Grohsmeyer.



Home-Made Clamp for Use by Electricians, Toolmakers, Etc.

Supporting Conduit in Concrete Forms.

When installing conduit in forms for reinforced-concrete floors or ceilings it is desirable to have the conduit well imbedded instead of coming close to the concrete sur-



Use of Extra Pipe Strap for Supporting Conduit in Concrete Forms.

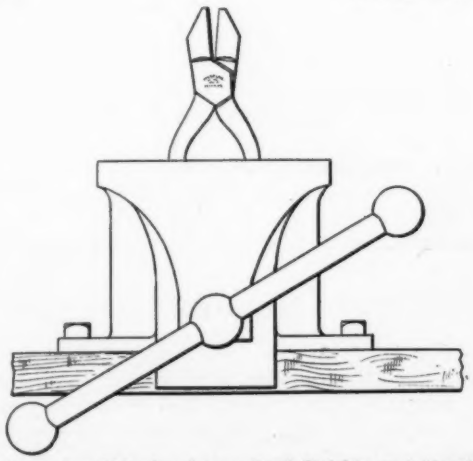
face. On a job which I am at present just finishing, the contractor objected because the conduit was laid directly on the flat ceiling forms. His objection was that the pipe would not allow the concrete to flow clear around it and therefore would leave a place for a crack to start in the ceiling and besides it would not leave his job with a smooth finish. I therefore hit upon this method of keeping the concrete well off the boards, so that the grout may be run under the conduit and the latter held securely in position. The scheme, as shown, consists merely of placing an additional pipe strap under the conduit which removes it sufficiently from the concrete surface.

J. B. Story

Method of Skinning Lamp Cord.

Nearly every one knows how hard it is to remove the insulation from lamp cord without cutting the fine stranded wires of which it is made up. A very convenient method for skinning lamp cord or other flexible wire has been found by me to be the one shown in the accompanying sketch. Take a pair of diagonal cutting pliers and clamp them in a vise, leaving an opening just large enough to let the conductor go down in the slot. Now on pulling forward on the wire or cord the insulation is cleanly cut and it is possible to skin five ends of cord against one with a knife.

George W. Otto.



Scheme for Skinning Lamp Cord Quickly and Neatly.

National Association of Electrical Inspectors

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"LET THE CODE DECIDE."

Secretary's Message.

The Secretary feels that he owes an apology to all the members for the way in which he has carried on the affairs of the office lately. His excuse is that since February he has been having a severe trouble with his eyes, which is even now far from cured, and which has at times rendered them entirely useless for reading or writing. As he has to do the work mostly himself, the results have been obvious. He can only say that as things are now he expects to return to normal conditions shortly, partly as a result of complete rest from work which a month in the woods will give.

Please note that the Secretary's address will be R. D., South Orrington, Maine, till further notice.

The Secretary desires to call the members' attention to the following changes in the Executive Committee:

New York Section: O. E. Smith resigned and in his place C. C McIntyre was elected. I regret to state that Mr. McIntyre recently died and his place will not at present be filled, so that the New York Section is at present with but one representative on the committee (Mr. Pomares) elected by the Section. However, as J. C. Forsyth, chairman of the committee (appointed by the president), is a member of that Section, it has ample representation.

Charles Clement McIntyre died after a short illness at his home in Woodhaven. He had been employed for ten years on the electrical inspection staff of the Suburban Fire Insurance Exchange, and was highly esteemed by all who knew him. He was also prominent in the Boy Scout Movement.

Western New England Section: L. N. Heebner, of South Manchester, Conn., was appointed to take the place of Mr. Perry.

California Section: B. C. Hill, of Oakland, replaces Mr. Kempston.

British Columbia Section: J. C. Digby replaces Mr. Hubbard.

The following letter has been received from Secretary Wentworth, of the National Fire Protection Association, and the Secretary takes this method as the most effective way of getting the information before the members, as requested:

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Boston, June 19, 1916.

Nat'l Ass'n of Electrical Inspectors,
Mr. W. Lincoln Smith, Secretary,
Concord, Mass.

My Dear Mr. Smith:

I wonder if you are advised that the Underwriters' Laboratories contemplate putting into effect very soon a new method of marking snap switches inspected at the factories? Arrangements have been made with certain manufacturers (which I list below) under which their product is to be stamped with a die abbreviated "Unds. Labs. Insp." This die-marking will replace the sticker label, which you are accustomed to see on inspected switches. It is possible that all your members will derive this information from the electrical journals, but we anticipate occasionally encountering an inspector who may be inclined to reject switches marked under the new plan. We are taking this matter up with Wire Commissioner Cole, of Boston, and thought we had better write you on the subject also, bespeaking your co-operation in the matter. Switches will, of course, appear for some time bearing the sticker label. Where the latter is not found, the other marking should be looked for. The location of the marking will be as follows on the various types:

1. Flush types—
   - A. Push button—on the yoke.
   - B. Rotary—on the ears.
   - C. Door switches—on the plate.
2. Surfaces types—on the cover.
3. Pendent—on the shell.

Very truly yours,
Franklin H. Wentworth.

Arrow Electric Company, Hartford, Conn.
Bryant Electric Company, Bridgeport, Conn.
Electric Specialty & Supply Co., Toronto, Ont.
General Electric Company, Schenectady, N. Y.
Gordon Electric Manufacturing Co., Chicago, Ill.
Hart & Hegeman Manufacturing Co., Hartford, Conn.
John I. Paulding, New Bedford, Mass.
Standard Electric Manufacturing Co., Chicago, Ill.
Trumbull Electric Manufacturing Co., Plainville, Conn.

Plug Fuses on Three-Wire Two-Wire System.

Question 328. On a three-wire, 220-110-volt system with a grounded neutral, are Edison plug-type fuses approved

for use on circuits feeding both 220-volt and 110-volt apparatus? Example: a three-wire No. 14 branch circuit with four 60-watt 110-volt tungsten lamps, two on each side, runs into a little shop, then the neutral dead-ends and the two outsides continue across the room to a 0.5-horsepower 220-volt motor.

Answer 1(E). In the specifications for plug fuses, see Rule 68, Section *f*, Paragraph *B*, appears the following:

"Approved plug or cartridge fuses in approved castings for Edison plug cutouts not exceeding 125 volts, but including any circuit of a three-wire 125-250-volt system with grounded neutral."

The words "including any circuit of a three-wire 125-250-volt system with grounded neutral" would, in my opinion, give to an installing electrician the right to use plug fuses in an installation of the type described in the question and an inspector, if working under Code rules, would approve of such use. This has been my understanding and practice.

Answer 2(O). Edison plug-type fuses are approved for use at any point on a 125-250-volt, three-wire system with properly grounded neutral (see Rule 68*f*, also List of Fittings—fine-print paragraph under heading, Fuses (Plug Type). In the example given under this question the three-wire branch circuit is contrary to the Code for the reason that under Rule 23*d*, fifth paragraph, all branch circuits connected direct to lamp sockets, etc., must be run as two-wire circuits.

Answer 3(S). Yes, see Rule 68*f* of the Code, also page 26 of the 1915 List of Electrical Fittings. There is quite a difference between a grounded neutral and one which is not grounded.

Answer 4(B*). Strict interpretation of the Code would forbid the use of plug type of fuses under the conditions referred to, although taking into consideration the capacity of the motor installation, I would see no particular harm in the use of fuses referred to in that particular case.

Answer 5(F and G). A three-wire, 110-220-volt circuit with four 60-watt, 110-volt lamps equally balanced and a one-half-horsepower, 220-volt motor connected across the outsides would be approved by us on the basis of a 660-volt circuit, that is, we would consider the three-wire circuit as one circuit and limit the load to 660 watts. With some types of alternating-current motors that require large starting current ten-ampere fuses would not be large enough and with a motor of this kind the above scheme of wiring would not be accepted. Plug fuses could be used to protect such a circuit, if the neutral wire is properly grounded.

Answer 6(T). Edison plug-type fuses 0 to 30 amperes would be approved for use on three-wire, 110-220-volt system with grounded neutral.

Answer 7(H*). Yes, provided approved fuse blocks are used.

Answer 8(P*). Yes, the practice on this point has not been uniform in the past, but it is now fixed by Rule 67*j*, third note, 1915 edition of the Code.

Answer 9(R*). I think this arrangement would be prohibited by a strict interpretation of Rule 68*f-B*. The motor circuit should be tapped before the three-wire cutout, and appropriate fuses installed.

Answer 10(D). I should say yes.

Answer 11(N*). Yes. Rule 68*f-B* says "any circuit of a three-wire, 125-250-volt system with neutral grounded." This being a three-wire *branch* circuit a fuse must be placed in the neutral (23*d*, paragraph 5). Query: does the omission of fuse in neutral as mentioned herein refer back to 22*a*, paragraph 3; or does it mean merely a fuse in the neutral of the branch circuit itself?

Allowable Number of Sockets on Signs.

Question 329. How many sockets for 10-watt 110-volt tungsten lamps may be placed on a single circuit in sign work?

Answer 1(D). 132.

Answer 2(O). The branch circuit feeding sign lamps is limited to 1,320 watts, hence permitting 132 sockets in this case.

Answer 3(R*). The Code limits the wattage to 1,320. This allows a maximum of 132 lamps.

Answer 4(P*). Not over 147 approximately. Rule 83*g* allows 1,320 watts to the circuit and the 10-watt, 110-volt lamp takes about 0.09 ampere. The circuit then would be carrying less than 15 amperes (capacity of No. 14 B. & S. wire) and this size fits receptacles properly.

Answer 5(H*). 132, see Rule 23*d*.

Answer 6(T). Rule 83*g* permits 1,320 watts to single a cutout with no reference to number of sockets or receptacles, hence I should allow 132.

Answer 7(E). No mention of socket limitation on electric signs is made in the Code. The rule does permit of 1,320 watts on a circuit; the circuit, however, should be fused, if 125 volts or less, with 20-ampere fuses; if 126 to 250 volts, with 10-ampere fuses.

Answer 8(F and G). 132 10-watt lamps may be placed on a single circuit in sign work.

Answer 9(B*). Under Rule 83*g* 132 would be permissible on a single circuit.

Answer 10(N*). 132 would be allowed under Rules 83*g* and 23*d*, paragraph 3.

Answer 11(S*). See Rules 83*g* and 23*d*. Under these 132 10-watt lamps could be placed on this circuit.

Isolated Stereopticon Lamp Pocket.

Question 330. A single pocket for a stereopticon is found in rear of a hall for general uses. Should it be insulated or grounded with the rest of the system?

Answer 1(D). Grounded.

Answer 2(O). Under Rule 38*f*, "Stage and gallery" pockets must be insulated from ground. This wording was evidently intended to cover floor pockets wherever located about the theater. The grounded pocket is dangerous in case the portable device which is connected thereto contains defective wiring.

Answer 3(R*). I think it should be grounded.

Answer 4(P*). It should be grounded. Ordinary theater stage conditions are absent here and there is slight chance of accident through the standard of a defective bunch light coming in contact with the grounded box.

Answer 5(H*). It depends on the system. Should not try

to insulate this pocket on a grounded system or installation.

Answer 6(T). Rule 38*f* requires all arc pockets to be of approved type and insulated from ground.

Answer 7(E). The requirements as contained in Rule 38, for the installation of stage pockets, do not apply to installations of this character. The ordinary stereopticon is without the hazards found in the stage equipments for which the stage pockets are intended. Should the conductors leading to the pocket be in conduit, the conduit should be grounded.

Answer 8(F and G). If the hall is of such character as to come under the classification "theater," as given in Rule 38, it should be insulated, otherwise not.

Answer 9(B*). It would depend largely on the location of the pocket. If it were on the *floor*, it should preferably be insulated.

Answer 10(N*). It should be grounded with the rest of the system.

Answer 11(S*). It is evident that the person who asked this question has been confused by reading Rule 38*f* of the Code. I should not consider that the rules for theaters would apply to this case and the pocket in question should be grounded with the rest of the system.

BOOK REVIEWS

"Wireless Telegraphy." By J. Zenneck. Translated from the German by A. E. Seelig, New York: McGraw-Hill Book Company, Incorporated. Cloth, 443 pages (6x9 inches), 469 illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $4.00.

This is a translation of the 1912 edition of Dr. Zenneck's "Lehrbuch der Drahtlose Telegraphie," in the writing of which the author approached the subject from the viewpoint of the physicist, rather than that of the engineer. Much attention is given to the explanations and theory of wireless telegraphy. In some respects those explanations concern quite elementary principles, such as the meaning of "effective current," and then again in more advanced theory detailed explanations are omitted, or a reference is given to some paper or book where the more complete explanation can be found. Such inconsistencies make the book rather difficult reading for one who is not already familiar with the subject.

Although the viewpoint of the author is that of a physicist, the practical applications have not been entirely overlooked. Much practical apparatus, mostly of German manufacture, is illustrated and its theory explained, even some that is now obsolete. The book is so full of theory, data, and other informational matter that the most significant portions cannot readily be pointed out. For example under the heading Detectors we find the following: thermal detectors, magnetic detectors, electrolytic detectors, crystal detectors, incandescent-lamp detectors, gas detectors and general consideration of detectors. Under each of these subdivisions are discussed various types and makes of detectors. Other subjects, such as high-frequency machines, receivers, transmitters, antennae, are treated with the same thoroughness. The book closes with a chapter on directive telegraphy and one on wireless telephony.

The numerous names of authorities printed in the body of the text are confusing and of no value to the general reader, especially when a comprehensive bibliography is appended. This last gives the book great value as a work of reference, for with the exception of Eichhorn's "Jahrbuch für Drahtlose Telegraphie" it is doubtful if a more complete list of references to the literature on the subject is in existence. The translation is a valuable addition to the English literature on wireless telegraphy.

C. M. Jansky.

"Electric Railway Engineering." By C. Francis Harding, assisted by Dressel D. Ewing. Second edition, revised and enlarged. New York: McGraw-Hill Book Company, Incorporated. Cloth, 416 pages (6x9 inches), 190 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $3.00.

"The Electric Railway." By A. Morris Buck. New York: McGraw-Hill Book Company, Incorporated. Cloth, 390 pages (6x9 inches), 193 illustrations. Supplied by the Electrical Review Publishing Company, Inc., for $3.00.

The book on "Electric Railway Engineering" by Professors Harding and Ewing, of Purdue University, first came out in 1911 and was received with considerable favor. The application of electrical energy to manufacturing processes and to the transportation of goods and passengers has increased at such a rapid pace that there is no exact line of demarkation between civil, mechanical, and electrical engineering principles in practice. The book before me can thus be reviewed from any one of these viewpoints. If viewed from the viewpoint of the civil or field engineer, it will be found very incomplete. There is a chapter on Track Layout and Construction which gives merely a few general statements that are of no great help to a trained civil engineer to whom such work is usually intrusted. It would not be fair, however, to judge the book from this viewpoint, for it is plainly intended for men who are primarily interested in installing the railway equipment and operating the system. For these men, the book contains much of value. It treats of such subjects as Traffic Studies, Train Schedules, Motor Characteristics, Speed-Time Curves, Locomotive Train Haulage, Substation and Power Station, Load Curves, Location and Design, Transmission and Distribution Systems, Bonds and Bonding, Electroylsis, Signal and Dispatching Systems, Cars, Control Systems, Brakes, Electric Locomotives, Alternating-Current vs. Direct-Current Traction, and Electric Traction and Trunk Lines. The treatment is almost wholly non-mathematical. Where an analytical exposition is made, only the most elementary mathematics are employed.

Judging from the table of contents, the book by Professor Buck, of the University of Illinois, is very similar to the one discussed above. A closer inspection confirms one in the first impression. The use of mathematics is also limited, but where necessary the author does not hesitate to show the derivation of certain formulas by the aid of the calculus, and even hyperbolic functions. The material is divided into only 18 chapters, as a result of a more logical classification. For instance, instead of devoting one chapter to Motor Characteristics and another to Motors, the author combines the two subjects under the heading Motors for Traction. Comparisons are proverbially odius and a reviewer treads on dangerous grounds when he attempts this. What appeals to one and seems logical, to another seems illogical, and hence variety is also the spice in book making.

C. M. Jansky.

"Oxy-Acetylene Welding and Cutting; Electric, Forge and Thermit Welding." By Harold P. Manly. Chicago: Frederick J. Drake & Company. Cloth, 215 pages (4x6½ inches), 56 illustrations. Supplied by Electrical Review Publishing Company, Inc. for $1.00; in leather, $1.50.

This volume is intended to give practical information upon the subject of welding by different processes and there is also a chapter on annealing, tempering, hardening and heat treatment of steel. Only a single chapter is given to the consideration of electric welding. This considers the different methods of resistance welding and also describes the use of the electric arc in welding, but does not explain its use in cutting. Some good practical hints are given but the method is not gone into very fully. One chapter is devoted to hand welding and another to thermit welding. The bulk of the volume, however, is devoted to the use of oxy-acetylene torch, which is treated in considerable detail and for which good practical instructions are given.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

Waynelite Transformer for Steadying Automobile Headlights.

The steady headlight illumination that drivers of Ford automobiles always have wanted is available now at low cost by the use of a specially designed transformer, known as the Waynelite. It has been impossible to get steady light on these cars as electrically equipped at the factory because the current supplied by the magneto naturally varies with the engine speed and the latter is influenced by every factor of the constantly shifting load and the driver's manipulation of the control levers.

At low speeds on high gear, when bad roads or danger of congested traffic emphasized the need of a bright light, it was not to be had. The magneto did not turn over fast enough to supply the necessary voltage. Not until the engine speed approximated 12 miles per hour was the light really useful. With the higher speeds the illumination was unnecessarily bright, lamps were frequently burned out and their lives shortened in any event.

But by the use of the Waynelite device the clear steady light desired becomes a fact at a wide range of speeds,

Waynelite Transformer for Ford Cars.

so that there is a really useful light at low speeds and a sufficient and economical light at other rates. The Waynelite is a small specially wound transformer, which has been perfected by the Fort Wayne Works of General Electric Company, Fort Wayne, Ind. It receives current from the magneto and delivers current to the headlight lamps, which are wired in multiple instead of in series as is the usual Ford factory practice. With the series wiring, if either lamp fails, both go out, to the driver's annoyance and perhaps peril. This is prevented by the multiple wiring recommended with the Waynelite device.

Installation is simple. The only changes from standard equipment of the Ford are adding the Waynelite, partial rewiring and substitution of 6-volt lamps for the 9-volt lamps usually supplied on the Ford. These changes are easily made.

Over-all dimensions of the Waynelite transformer are 3.75 inches wide, 3.25 inches high and 4.25 inches deep. As it is practically waterproof, it may be placed on the dash or under the hood or floor boards with assurance that it will operate at all times desired, and is instantly ready for service.

Kliegl Portable Lighting Unit for Motion-Picture Photography.

On account of the great increase in the use of motion pictures for not merely theater, but also miscellaneous educational and publicity work, there has arisen a demand for a portable lamp especially adapted for facilitating the taking of motion pictures in any place where there is insufficient daylight. This demand has now been met by the development of what is known as the Kliegl Liliput arc lamp, which has now been placed on the market by the Universal Stage Lighting Company, 240 West Fiftieth Street, New York City. This is a compact and readily portable unit which can be used as freely in any place where pictures are to be taken as in the studios specially provided for this purpose.

Kliegl Liliput Arc.

This lamp has two pairs of carbons with automatic feed for operating on either direct current or alternating current. It takes only 15 amperes on circuits of voltages ranging from 110 to 125. The carbon holders are inclosed in an approved sheet-metal hood of special design, which has high reflecting power and therefore increases the efficiency of the illuminating unit about 50 per cent. On the front of the reflector is a groove or slide for inserting a diffusing screen. On the upper carbon holder there is an ingenious device in the center, comprising a swinging joint, which permits the carbons to assume the correct position the moment that the current is applied.

The lamp is entirely automatic and requires no operator to start it or to regulate the carbons. All of the live parts are well inclosed in the hood. The lamp-regulating rheostat is secured to the bottom of the lamp and serves as a base for the lamp to stand on when it is desired to use it without the adjustable stand. The latter, however, permits of ready adjustment to almost any desired practical height. The lamp itself is 33 inches high without the stand and 66 inches high with the stand. The weight of the outfit with stand and 25 feet of cable is 30 pounds. The latter consists of No. 14 flexible stage cable and is provided with a connector for readily disconnecting it from the lamp.

The outfit furnishes an evenly distributed and very intense flood of white light possessing high actinic value. The light furnished is said to be of equal value to the brightest daylight. This lamp is thoroughly practical and has given good satisfaction wherever tried.

Diaphragm-Type Pressure Regulators.

A pressure regulator of the diaphragm type, for use with automatic starters on motors driving pumps, compressors and similar machines, is shown in the accompanying illustration. This regulator requires but two wires to connect it to the starter and is designed for use in connection with compressors or pumps emptying into closed-pressure systems for air, gas, water or any fluid not injurious to the rubber diaphragm. The regulator can also be used with pressure systems operated by oil or steam, if a loop is introduced into the pipe leading to the

Diaphragm-Type Pressure Regulator.

regulator to prevent the oil or steam from coming into direct contact with the diaphragm. The regulator consists of four essential parts, the pressure chamber, the operating arm, the switch lever and the adjusting springs. The pressure cylinder is of cast iron, inside of which is a heavy flexible-rubber diaphragm. A piston attached to the diaphragm projects through the chamber and engages the operating arm which actuates the switch lever. The operating springs oppose the movements of the piston and can be adjusted to suit the requirements of the circuit on which the regulator is to operate. These regulators are made by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Electric Washer for Use in Stationary Tubs.

A washing machine which is creating much favorable comment is being manufactured by the Home Devices Corporation, Bush Terminal, Brooklyn, N. Y. This washer is known as the Modern Home Washer.

This washing machine is a little out of the ordinary, in the fact that the equipment can be placed in the stationary tubs which are in the average city home or in the average modern home in towns outside of the big cities. There are many homes, particularly in the big cities and in the larger towns, where there is not sufficient room for a washing machine with its own portable tub. The washer overcomes this drawback, since the equipment can be placed right in the stationary tubs in the house, it occupies no extra space as, after the washing is finished, the washer may be left in the tubs.

The washer is built for electric power, and also for hand power. The electric equipment consists of a one-eighth-horsepower General Electric, ball-thrust motor, the driving mechanism, the wringer, the wringer-drive shaft, and the cylinder in which the clothes are washed.

The machine is of the perforated-cylinder type, which eliminates the danger of tearing clothes, such as sometimes happens in machines of the dolly or peg type. It also eliminates wear and tear on the clothes, such as is likely to occur in the old-style corrugated wood tubs. Being entirely of metal, it also does away with the possibility of the clothes being torn on slivers or splinters of wood.

The gears in this machine are all machine-cut, are fully inclosed in a tight gear case, and run in hard oil. All the bearings for the pinions in these gears are of bronze. The machine employs direct drive, no belts or straps being used. On the end of the motor shaft is a worm, which in turn drives a worm gear.

In operating the washer, the cylinder makes about ten revolutions in one direction in twenty seconds; then the cylinder stops and reverses for ten motions in the opposite direction. Both the washer and the wringer may be operated at the same time, or one may be operated independently of the other. The wringer is also reversible; it has a five-year guarantee and is equipped with 11-inch rolls, and ball bearings. Where there are no stationary tubs in the home, the same machine can be supplied with its own portable metal tubs.

All parts are thoroughly galvanized. On account of the present extremely high price of zinc, the Home Devices Corporation recently installed its own galvanizing plant, thereby insuring itself against any shoddy or defective galvanizing.

The machines are sold through dealers only and are merchandised on the exclusive agency proposition. Until recently, the company has devoted practically all its efforts to the East, but now is anxious to make good connections through the Middle West. The washer has

Electric Washer for Use in Stationary Tubs.

been tested and approved by Good Housekeeping Institute and received a medal at the Panama-Pacific International Exposition.

New High-Tension Suspension Insulator.

One of the greatest problems in high-tension power transmission is in properly insulating the lines. Great developments in the construction of insulators have taken place, par-

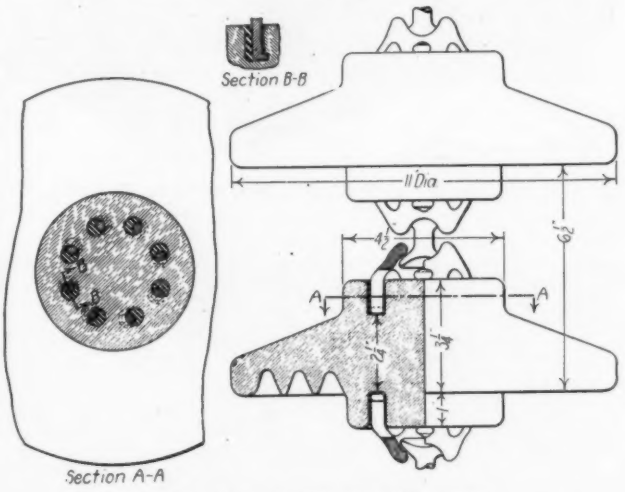
New Type of Suspension Disk Insulators Being Placed on Market by the Jeffery-Dewitt Company.

ticularly since the introduction of the suspension-type units. An interesting development in this line is now promised in the new J-D high-tension disk insulators, which the Jeffery-Dewitt Company, of Detroit, Mich., is now ready to manufacture on a large scale. This company has in the last eight years established an enviable reputation in the manufacture of porcelain for spark plugs. As the result of exceptionable success in this line studies have been made on the construction of high-tension porcelain insulators and after long experimentation an improved design has been perfected. The manufacture of these insulators has been put under the direction of an experienced ceramic engineer, Robert M. Johnston, who has developed a superior process of porcelain making that is said to overcome the weaknesses of the older methods.

The design of the J-D disk insulator has aimed to produce a theoretically correct insulator as practical as possible. The marked distinguishing feature of the new unit is its great thickness of dielectric and the perfectly balanced field of stress due to the identical metal electrodes above and below. The minimum effective dielectric thickness of these new disks is 2.25 inches, or about three times this amount for the single-piece units now in use. The stress on the porcelain under all operating conditions is correspondingly lower than on the thinner types. Authorities have proved that insulating materials gradually fail under stresses which cause corona. The critical stress varies with the specific inductive capacity of the material; for porcelain, the safe potential gradient is about 40,000 volts per inch of thickness. The J-D disk unit, as proved by tests, both on normal and high frequency, avoids corona up to 90,000 and even 110,000 volts, whereas a disk 0.75 inch thick is under corona at 30,000 volts. The manufacturer believes the new unit will insulate permanently, because of its safe dielectric stresses. The perfectly balanced field is also very important in securing the full value of the insulating material and enabling the insulator to resist high frequency and other line conditions caused by lightning and switching. In the cap and pin type the area of contact with cement outside is six or seven times that in the pin hole, causing a greatly concentrated stress on the porcelain next the pin hole.

Several power companies have tested the new disks under oil and punctured some at 300,000 volts. The manufacturer regards 250,000 volts as an average value for puncture strength. These insulators have stood high-frequency flashover for one hour. Each unit is tested mechanically to a strain of 5,000 or 6,000 pounds, then it is tested electrically to flashover for ten minutes on a 60-cycle transformer. A high-frequency oscillator is being built for the company for testing at 250,000 volts. As soon as this is finished, all insulators will be tested on high frequency. The company strongly believes in using high frequency, as it is better to find the weaknesses before putting the insulators on the line than afterward.

High-Frequency Test of Five J-D Disk Insulators at 600,000 Volts and 100,000 Cycles per Second. First Static Discharge Occurred at 500,000 Volts.



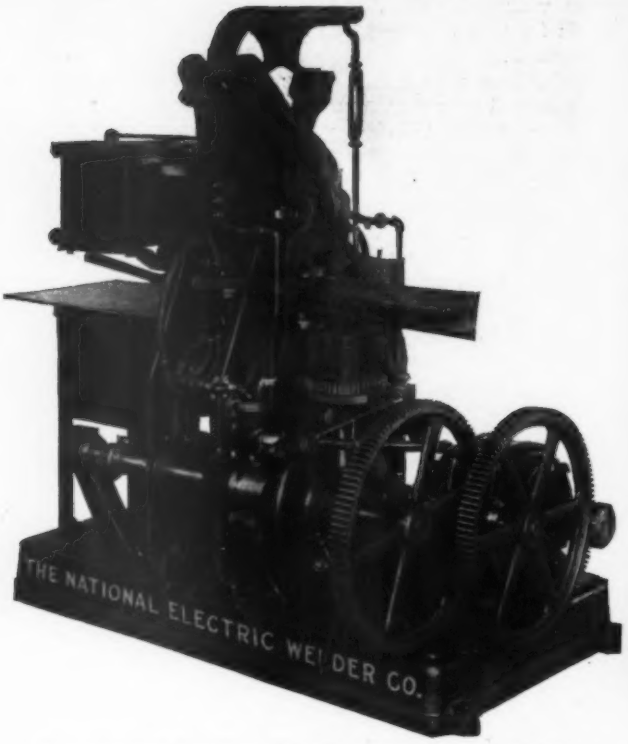
Details of J-D Disk Insulator Units.

Special Electric Spot Welder.

As an instance of the extent to which electric welding can be developed, the illustration (on next page) of a special spot welder is of considerable interest. This welder was designed and built by the National Electric Welder Company, Warren, O., and is used in assembling sections in an eastern plant which makes a specialty of pressed-steel forms.

The fact that the machine is wholly automatic in its operation will convey some idea of the high degree of mechanical and electrical skill involved in its construction. Power is delivered through a train of gears from a 2-horsepower motor mounted on the machine base and operating at 1,200 revolutions per minute. The work is run through the machine in 12-foot lengths, the spot welds on each side being automatically made at the same time and at the rate of 40 per minute.

A cam (shown just to the left side of the second large gear) operates a ratchet gear (shown to the left of the top of the second large gear), which in turn operates the friction rollers that carry the section through the machine. During the intervals between the ratchet-gear movements, the welding points are brought into contact with the work by means of the cam shown between the uprights of the frame just below the water



Automatically Operated Electric Spot-Welding Machine.

hose. The welding points are water-cooled, the temperature and flow of the water being indicated in the drip cut through which the water passes as it flows from the cooling system into the waste pipe.

Despite the seeming complication of parts, the machine is exceedingly simple in working principle, so much so, in fact, that it would require actual abuse to impair its efficiency. The possibility of such abuse is provided for by unusual sturdiness of construction and liberal provision for emergency overloads.

This special machine will take the place of several riveting machines, which will be utilized for work on which electric welding is not economically practical.

Large Theater-Dimmer Installation in Oakland's New Municipal Auditorium.

The interior of the new Municipal Auditorium at Oakland, Cal., is divided into an arena and a theater, a stage separating them. The arena seats about 10,000 and the theater 2,000. In making provision for lighting the stage, the consulting engineer, Romaine W. Myers, of Oakland, had

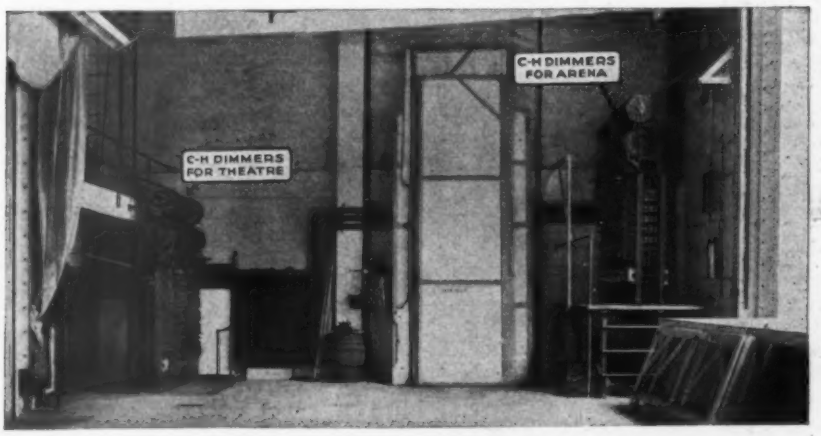


Fig. 1.—View on Stage of Oakland Municipal Auditorium, Showing Location of Dimmers.

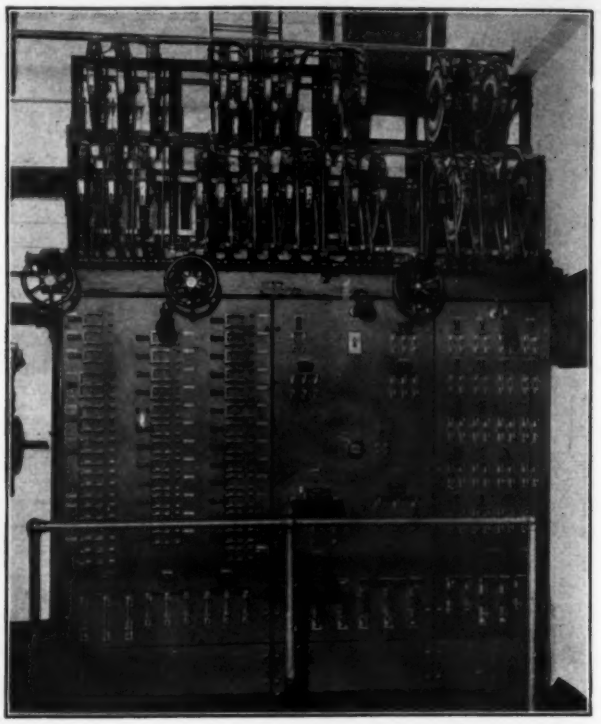


Fig. 2.—Dimmer Equipment for Oakland Municipal Theater.

five borders installed, each border having red, white and blue lamps. There are over 1,500 40-watt lamps in the borders, a large amount of light being necessary because the balcony of the arena is 250 feet from the stage. These border lights together with the lamps in the foots, strips and pockets are controlled by Cutler-Hammer dimmers, which are installed in two banks, one for the arena and the other for the theater. The accompanying illustration, Fig. 1, shows the position of these dimmers, while Fig. 2 shows the dimmer equipment that controls the theater lamps. The dimmer plates, as will be noted, are operated by means of handwheels located within easy reach of the stage electrician. Electric service is furnished by the Pacific Gas & Electric Company.

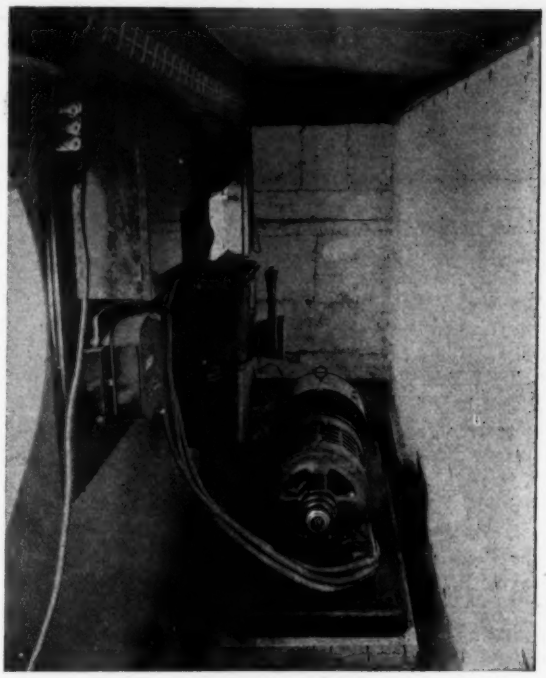
Motor-Generator Set for Motion-Picture Projection.

In order to obtain a clear steady arc light for the operation of motion-picture machines it is necessary to have direct current as a sourse of supply, as with alternating current the arc flickers, is difficult to focus, and requires more current. The result is usually poor, indistinct pictures. Where only alternating current is available, therefore, means are generally provided for converting the alternating current into a suitable direct current. The management of the Orpheum Theater, Allentown, Pa., having to depend upon alternating current as a source of supply, and being desirous of showing pictures on the screen to the best advantage, recently installed a four-kilowatt, two-light, motor-generator set made by the Westinghouse Electric & Manufacturing Company. This set, similar to the one illustrated, converts three-phase, alternating current to direct current at 75 volts. As only 55 volts is actually required at the arc, however, the generator voltage is reduced to this potential by means of non-

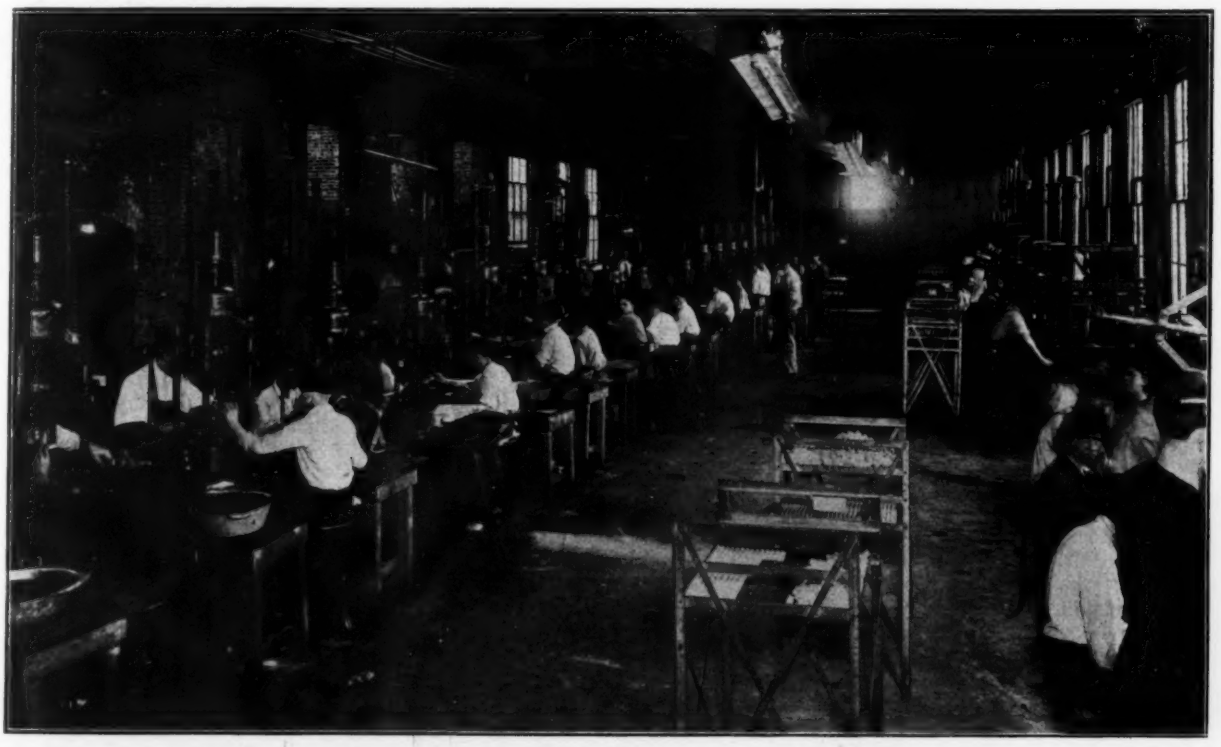
inflammable, well ventilated, grid-type steadying resistors having 10 steps for adjustment. This leaves the operator free to concentrate his attention on the adjustment of the lens and the projection of the picture, as no difficulty is experienced in adjusting and holding the arc. The motor operates on the regular three-phase supply circuit. The generator is of the commutating-pole type, compound wound, in order that a constant voltage may be maintained irrespective of the amount of current used. The ballast resistors in series with the lamp tend to maintain a constant current through the arc and thus give a steady light.

The object of installing a two-light set was so that, when a two, three or four-reel picture was being run, one reel could be "faded in" on a second machine simultaneously with the "fading out" of the reel on the first machine. To fade in a second reel, it is necessary to warm up the carbon on the second machine for about one minute before the reel on the first machine is faded out. By using a two-light motor-generator set this is accomplished without varying the voltage so that the picture is not interrupted nor, in the case of motor-driven motion-picture machines, is the speed altered, which is a very important consideration.

The set has been worked to its full capacity and the operation is highly satisfactory. The Westinghouse company manufactures this line of motor-generator sets in capacities from 2.75 to 6.75 kilowatts, and designed especially for producing the desired direct current at the most suitable voltages for the satisfactory projection of pictures. A medal of honor, the highest award obtained on this class of apparatus, was granted these sets at the Panama-Pacific International Exposition at San Francisco last year, where these sets were exhibited by themselves and also used in connection with motion-picture displays in the exhibits of several other companies.



Motor-Generator Set for Picture Projector.



View in the Molding Department of the Hemming Manufacturing Company's Factory.

Since the introduction of insulating compounds several years ago there has been great development in this branch of the industry and an extraordinary increase in the use of molded insulations. These insulating compounds are now prepared for special properties, of which mechanical strength and resistance to heat are specially important. The Hemming Manufacturing Company, Garfield, N. J., has devoted its entire energies to the development and production of heat-resisting molded insulating materials, with the result that its factory has in the last few years been increased from a floor space of 6,000 square feet to a present area of 40,000 square feet. The company makes its compounds under its own patented processes. The raw materials are carefully selected and tested and, after being properly compounded, are taken to the molding department, a view of which is shown above. A cold molding process is used in which the material is formed into the desired shapes in steel dies by means of hydraulic presses. After being pressed, the pieces are dried in ovens and finally polished or buffed in the finishing department. The company makes three kinds of insulating products, known as Gummon, Tegit and Hemit, which have slightly different properties. In the large variety of articles molded of these materials are included, socket, receptacle and plug bodies and parts, cutout and switch bases, covers and handles, third-rail insulators, arc separators and controller parts, bushings, barriers, etc.

INDUSTRY ACTIVITIES

Ward Leonard Electric Company has announced the removal of its main office and factory to its new location in Mount Vernon, N. Y.

The Fort Worth Battery Company, of Fort Worth, Tex., is preparing to engage in the manufacture and sale of electric batteries. R. E. Cole is interested in the company.

Roller-Smith Company, 233 Broadway, New York City, has issued Bulletin No. 200, on portable direct-reading bond testers for testing the conductivity of rail bonds.

Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York City, has issued Bulletin No. 48,906, on its type S-1 electric hoists of one-half and one ton capacities.

The Pioneer Corporation, 1249 West Sixty-third Street, Chicago, Ill., manufacturer of eradium (luminous) products, has published folders on its eradium switch plates, pull-chain bulbs, and clocks.

United Battery Corporation announces an increase in its manufacturing facilities by acquiring additional space. The corporation's executive offices have been removed from the factory and are now in the Woolworth Building, New York City.

Rutenber Electric Company announces the removal of its general offices and factory equipment to its new factory at Marion, Ind. The company has greatly increased its manufacturing facilities and is in a position to take care of all orders promptly.

Robbins & Myers Company, Springfield, O.—A second new addition to its factory is to be constructed by the company this summer, immediately following the completion of the one now in course of construction. The company will also build an office building near the plant during the next year, according to President C. F. McGilvray.

The American Manufacturers' Agency, Harris Trust Building, Chicago, Ill., is introducing to the architects and building trades the Newton toggle switch made by the **Newton Manufacturing Company,** Lynbrook, N. Y. This switch is guaranteed high grade, simple in construction, strong and designed to last under heavy service.

Ohio Brass Company, Mansfield, O., after July 1, will act as general sales agent in the United States for the entire line of Crouse-Hinds Imperial headlights for railway and mine use. The Imperial line enables the user to obtain the headlight best suited to any condition, as it contains a complete assortment of luminous arc, carbon arc and incandescent headlights. The Ohio Brass Company has made extensive preparations for the taking over of this line and will be in position to offer to its customers the same service on headlights that has always been given with the sale of its other materials.

Movies to Move Audience to Wash Electrically.—A motion picture devoted to the electric washing machine and iron has made its appearance under the title of "The Education of Mrs. Drudge." This film shows how a woman shackled to the old-fashioned wash tub is emancipated and made happy by the purchase of an electric washing machine and iron. It is advertising that is subordinated to human interest, and thereby gets across its double message. The picture has been produced by the Western Electric Company and is furnished to central stations and electrical dealers to further their sales of the commodities shown. The reels, which are 1,000 feet long, are in big demand and are well received wherever shown. Western Electric offices are booking them for advance production.

Electrose Manufacturing Company, Brooklyn, N. Y., has notified all of its departments that employees called for service in connection with the Mexican mobilization will be granted leave of absence with full pay, and their positions will be held open for them. The full pay which the men will receive will be in addition to pay received from the government.

The Sothman Construction Corporation has been organized with headquarters at 40 Exchange Place, New York City. The corporation is organized to carry on general electrical construction work, such as erecting transmission lines, installation of submarine cables, construction of underground distributing systems, power plants, lighting plants, electric railway systems, etc. The organization is made up of men of exceptional abilities, each one having had wide and varied experience in his respective line.

The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, O., has been awarded a silver medal by the Third National Exposition of Safety and Sanitation, New York City, May, 1916, in recognition of work done in the promotion of safety through its campaign for clean lamps and the development of safety cutout hangers, or automatic disconnecting lowering devices, which are being used extensively by industrial plants and railroads. The device is designed especially for use on large Mazda and type C or nitrogen lamps, the object being to keep the lamp cleaners on the ground in a position of safety, and to make it so easy and safe to get at the lamps for cleaning so that there will be no excuse for losing the benefit of a large percentage of the light which they are producing.

Westinghouse Electric & Manufacturing Company has recently received the following orders: For installation in the Curtis Bay substation at Baltimore, the Baltimore & Ohio Railroad Company has purchased three 500-kilowatt rotary converters; three 500-kilovolt-ampere, oil-insulated, self-cooling, three-phase, 25-cycle, 13,200-volt high-tension, rotary low-tension transformers; four 50-kilovolt-ampere, single-phase, 25-cycle, 13,200/550-volt transformers, and one 17-panel switchboard. This substation will supply energy to the Curtis Bay coal pier, one of the largest coal piers in the country. Energy will be furnished to the substation by the Baltimore Consolidated Gas & Electric Company. An order of approximately $90,000 has been received from the Chili Exploration Company, for two 450-horsepower, self-starting, three-phase, 50-cycle, 500-volt synchronous motors for compressor service, with shoe rails, dampers and starting auto transformers for 100-per-cent power factor operation; two 10-kilowatt(125-volt, 1,080-revolutions-per-minute exciters, and two starting panels, to be installed at Antofagasta, Chili. The Utah Copper Company and its allied interests have placed orders for 211 vertical agitator motors for separating copper from low-grade ore and tailings by the use of the flotation system. The Tacoma Smelting Company has ordered ten complete equipments, consisting of motor-generators, transformers and switchboards, for precipitating smelting fumes by the Cottrell process. The Butte & Superior Copper Company has purchased a flywheel motor-generator and direct-current hoisting equipment. Similar equipments have also been sold to the United Verde Company, Jerome, Ariz., and the Hercules Mining Company. The Pennsylvania Lines West of Pittsburgh have purchased four 600-ampere electric and welding equipments.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

ARMORED CABLE.—Thomas & Betts Company, 105 Hudson Street, New York, N. Y.

Marking: Monogram T-B stamped in armor at intervals of about six inches, or red gasket between turns of armor.

Listed April 17, 1916.

CABINETS AND CUTOUT BOXES, Sheet-Metal Type.—Fish & Horton Company, 123 Mill Street, Rochester, N. Y.

Standard. Label service.

Listed May 10, 1916.

CORD FOR ELECTRIC HEATERS, Portable, Flexible.—D. & W. Fuse Company, Providence, R. I.

Marking: Felted asbestos insulation on each conductor. Tag on coil to read "Nat'l Elec. Code Standard."

Listed May 16, 1916.

ELEVATOR-CONTROL APPLIANCE.—Sturm Dumbwaiter & Elevator Company, 289 Union Avenue, Portland, Ore.

Reversing switch for changing direction of motor on Sturm motor-operated dumbwaiter. This switch, of inclosed drum and finger contact type, is rated 30 amperes, 250 volts, alternating or direct current.

Listed May 16, 1916.

FITTINGS FOR CONDUIT BOXES, Supports.—Pass & Seymour, Incorporated, Solvay, N. Y.

Sheet-steel supports for securing receptacles and rosettes in 3¼-inch outlet boxes not provided with threaded lugs for attaching covers on receptacles. Catalog Nos. 1181-82.

Listed May 16, 1916.

FIXTURE FITTINGS. — Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Wall flange fixture supports with porcelain bushings, catalog Nos. 5031-32.

Listed May 11, 1916.

FIXTURES, Vaporproof.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Catalog Nos. 1565-66, 1568, 1578-79, 1563.

Listed May 6, 1916.

RECEPTACLES, For Attachment Plugs.—Bryant Electric Company, Bridgeport, Conn.

Disappearing door type, 10 amperes, 250 volts, plugs for same, catalog No. 539.

Listed May 19, 1916.

RECEPTACLES, Standard.— Pass & Seymour, Incorporated, Solvay, N. Y.

P. & S. brass shell, closed or slotted bases. Key, 250 watts, 250 volts, catalog Nos. 7530, 7532, 61387, 66609, 68136, 68139, 68244. For use on metal ceilings, catalog No. 7513.

Listed May 16, 1916.

SIGNS, Electric.—Louis E. Meyers Company, Richmond, Va.

Electric signs shown to be in accordance with requirements of the National Board of Fire Underwriters and examined at the factories and passed by Underwriters' Laboratories have labels attached.

Listed May 5, 1916.

SIGNS, Electric.—Sign Ad Company, Geneva, N. Y.

Electric signs shown to be in accordance with requirements of the National Board of Fire Underwriters and examined at the factory and passed by Underwriters' Laboratories have labels attached.

Listed May 15, 1916.

SOCKETS, Standard.—Anylite Electric Regulator Company, Fort Wayne, Ind.

A combination of a keyless brass-shell socket and Edison type attachment plug with a resistance wire and regulating switch connected in series.

Enclosed Switch.—The Trumbull Electric Manufacturing Company.

Listed April 20, 1916.

SOCKETS, Standard.—Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins metal-shell sockets. Keyless, 660 watts, 250 volts, catalog Nos. 7402, 7404, 7406, 7408, 9392, 43390, 50768, 99392, AA-13, AB-13, AD-13, AE-13, AF-13, AG-13, AH-13, AK-13, AL-13, AM-13, AN-13, AP-13, AS-13, AT-13, AU-13. Electrolier, for fixture use only, catalog Nos. WA-83, WB-83, WE-83, WF-83, WG-83, WK-83, WL-83, WM-83, WN-83, WP-83, WR-83, WS-83, WA-95, WB-95, WC-95, WE-95, WF-95, WG-95, WK-95, WL-95, WM-95, WN-95, WP-95, WR-95, WS-95, 4043, 4044, 50766, 66237.

Twin sockets, catalog Nos. 46750-52.

Candle socket, catalog No. 4004 when installed with casing or "Candle."

1500 watts, 600 volts, catalog Nos. 4021-22, for use with incandescent lamps in series on 600-volt circuits. Catalog No. 4089-Special.

Also above types with shadeholders.

Listed May 19, 1916.

SOCKETS, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

P. & S. brass shell, key, 250 watts, 250 volts, catalog Nos. 824-27, 7500, 7506, 7509, 59480-81, 59486.

Also above types with shade holders attached; key types with composition or insulated metal key; pull sockets with extension chain guide or insulating link in chain. Also above types with "Shurlock" attachment.

Listed May 16, 1916.

SOCKETS, Weatherproof.—General Electric Company, Schenectady, N. Y.

G. E. Co. porcelain shell, 660 watts, 600 volts, catalog No. GE525; 1500 watts, 600 volts, catalog Nos. GE068, GE069, GE104, GE518, GE519, GE520.

Listed May 16, 1916.

SWITCHES, Combination Cutout.—Connecticut Electric Manufacturing Company. Bridgeport, Conn.

C. E. M. Co. Double-pole switches with plug fuses, 30 amperes, 125 volts, catalog No. 15012. Branch-circuit panel switches, 30 amperes, 125 volts, catalog Nos. 1505-07, 15015-17. Three-pole, branch-circuit panel switches, 30 amperes, 125 volts, catalog Nos. 1504, 15014.

Listed May 23, 1916.

SWITCHES, Enclosed.—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Two-pole knife switches and cutout bases for standard plug fuses. Enclosed in metal cases and designed for manual operation without opening cases. "Circle T," 30 amperes, 125 volts, catalog Nos. 5640-41, 5644-45.

Listed May 16, 1916.

SWITCHES, Surface Snap.—General Electric Company, Schenectady. N. Y.

G. E. with metal covers. Series-parallel, 7.5 amperes, 250 volts; 15 amperes, 125 volts; catalog No. 169900.

Listed April 8, 1916.

WIRE CONNECTORS. — United Cable Connector & Manufacturing Company, 1837 North Bucknell Street, Philadelphia, Pa.

Solderless cable connectors, for connecting branch cables to main lines.

U. C. C. Type T. Sizes for No. 0 B. & S. gauge to 1,000,00 circular-mil stranded cable.

While these connectors are not considered satisfactory substitutes for soldered joints in general wiring, they are deemed suitable for use in connecting terminal wires of motors, starting compensators, and other electrical apparatus to supply mains where it is desirable to frequently disconnect such supply mains from the apparatus, and where such connections are open to view. The joints must be well taped.

Listed June 13, 1916.

PERSONAL AND BIOGRAPHICAL

BRIGADIER-GENERAL EDWIN W. HINE, Newark, N. J., has resigned as secretary of the Public Service Corporation, on account of military duties in connection with the mobilization of the National Guard.

MR. WALTER N. WALMSLEY has been appointed general manager of Alabama Power Company, a subsidiary of Alabama Traction, Light & Power Company, to succeed MR. F. H. CHAMBERLAIN, who had recently resigned.

MR. EDWARD N. HURLEY, chairman of the Federal Trade Commission, has accepted an invitation to speak at the Third Annual Babson Conference, which will be held at Wellesley Hills, Mass., during the latter part of the month of September.

MR. L. L. KELLOGG, president of the Sioux City (Iowa) Gas & Electric Company, has been selected manager for the Sioux City Electrical Prosperity Week to be held December 2-9. Preparations are being made to make the electrical show even a greater event than it has been in preceding years.

MR. L. H. LATHROP, former superintendent of the Menominee (Mich.) Traction Company, has been appointed general superintendent of the Ironwood, Mich., plant of the Ironwood & Bessemer Railway & Light Company, of Ashland, Wis. MR. J. C. DONALD, of Asheville, N. C., has been appointed assistant general manager of the latter company.

MR. WILLIAM E. WICKENDEN, assistant professor of electrical engineering in Massachusetts Institute of Technology, Cambridge, Mass., has been advanced to the rank of associate professor in the same institution. MESSRS. RALPH G. HUDSON and WALDO V. LYON have been advanced from the grade of instructors to assistant professors of electrical engineering.

MR. S. B. WAY, vice-president and general manager of the Milwaukee (Wis.) Electric Railway & Light Company, recently gave an address before the members of the Advertisers Club in Milwaukee, and outlined reasons why lighting companies buy advertising space in daily newspapers. He said the purpose was to increase the sale of its product as well as to give the public information it is entitled to receive.

MR. PHILIP D. LAIRD, of Montgomery County, Md., has been reappointed a member of the Public Service Commission of Maryland. Mr. Laird was made a member of the Commission when it was created in 1910 and became its chairman in 1911. Close attention to his work affected his health about a year ago and he therefore resigned to devote his energy to recuperation. His reappointment follows the happy complete recovery of his health. Mr. Laird's long service on the Commission and his thorough grasp of public utility problems makes him one of the most valuable public service commissioners in the country.

MR. WILLIAM R. WILLCOX, for many years a member and until 1913 chairman of the Public Service Commission of the First District of New York, has been appointed chairman of the Republican National Committee, and will conduct the present Republican campaign.

MR. H. L. COLBY, formerly of Cincinnati, O., has been appointed general sales agent in one of the southern sales territories of the Domestic Engineering Company, manufacturers of the "Delco" farm-lighting equipment. Mr. Colby's headquarters will be in Memphis, Tenn.

MR. J. J. CARTY, chief engineer of the American Telephone & Telegraph Company, and who is president of the American Institute of Electrical Engineers, which held its annual convention

J. J. Carty.

in Cleveland, O., this week, was the recipient of the honorary degree of doctor of science conferred by Bowdoin College at its 111th commencement, June 22.

MR. JAMES G. WHITE, president of J. G. White & Company, New York City, has been re-elected third vice-president of the Merchants' Association of New York. The Association is organized for the promotion of the interests of New York City and the extension of its commerce and trade. Publicity, research, traffic, convention, industrial, foreign trade and legislation bureaus are maintained, each having its special field of work for the benefit of the city. The membership numbers over 5,000.

MR. HARLAN A. SAWYER, for 26 years superintendent of the Amesbury (Mass.) Electric Light Company, has been appointed manager of the Merrimac Valley Power & Buildings Company, Newburyport. Both these companies are subsidiaries of C. D. Parker & Company, Boston, Mass., and Mr. Sawyer will divide his time between the two interests. During his connection with the Amesbury plant it has quadrupled its business. It now furnishes lighting and power for Merrimac, Salisbury and Salisbury Beach, besides the town of Amesbury.

MR. J. G. PERTSCH, JR., formerly instructor in electrical engineering at Sibley College, Cornell University, has been promoted to the grade of assistant professor. MR. J. F. PUTNAM has been appointed assistant professor of electrical engineering at the same institution. The latter formerly was professor of physics in St. John's College, Shanghai.

MR. LOUIS B. VAN NUYS, who was recently elected secretary and treasurer of the Electrical Contractors' Association of the State of Illinois, is one of the leading contractors of Peoria, Ill. He is president and general manager of the Central Electric Company of Peoria, which conducts a general electrical contracting business and also has a splendidly arranged electrical store on South Jefferson Avenue, where an up-to-date stock of electrical appliances, fixtures and supplies is kept on sale. Mr. Van Nuys is prominent in the Peoria Electric Club and several civic organizations.

MR. ROBERT E. HUGHES, former president of the Kentucky Electric Company, which was absorbed by the Louisville Gas & Electric Company, is chairman of the campaign committee of the Louisville Industrial Foundation, which is beginning a campaign to raise $1,000,000 to be utilized in bringing new industrial enterprises to that city. MR. DONALD McDONALD, vice-president and general manager of the latter company, and MR. F. M. SACKETT, former president of the Louisville Lighting Company, which was also absorbed by the gas and electric company, are leading members of the same committee.

MR. C. A. LUCKEY has been appointed resident manager of a new sales office established by the Edison Storage Battery Supply Company, at 201 Baronne Street, New Orleans, La. Mr. Luckey is a graduate of Franklin Military Academy, Franklin, N. Y., class of 1899, and Bliss Electrical School, Washington, D. C., 1900-1901. He was connected with the Western Electric Company, New York City, during 1901-1902, leaving there to go with the Safety Car Heating & Lighting Company, where he remained until 1911, spending the first four years in its electrical laboratory and then going with the Chicago branch. In 1911 Mr. Luckey was with the Railway Utility Company, Chicago. In 1912 he joined the sales force of the Edison Storage Battery Company, Orange, N. J., and was attached to the sales office in Chicago, where he has been until his present appointment.

OBITUARY.

MR. R. W. FERGUSON, general manager of the United States Incandescent Lamp Company, was killed on June 6, by an explosion of an oxy-acetylene torch apparatus at the lamp company's factory in St. Louis, Mo. Mr. H. G. Ferguson, proprietor of the lamp company, was near his brother when the explosion occurred, but fortunately escaped serious injury.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

ELLSWORTH, ME.—The Bar Harbor and Union River Power Company, L. A. Leach, superintendent, has begun the rebuilding of the local electric-lighting system.

OAKFIELD, ME.—The Oakfield Light & Power Company has been incorporated with a capital stock of $10,000. The incorporators are Nelson C. Martin, Preston H. Martin, Walter E. Mathews, L. A. Barber, G. H. Grant, L. Martin, M. W. Trafton, L. R. Allen, Oakfield, and William H. Kelley, Bangor, Me. The company will do an electric light and power business.

NASHUA, N. H.—A modern system of street lighting will be installed if plans now being discussed are carried out by the City Council.

MONTPELIER, VT.—The petition of the Central Power Corporation for a certificate providing for the establishment and maintenance of the proposed corporation has been granted by the Public Service Commission, and the company will enter the power field.

ST. JOHNSBURY, VT.—The Essex Storage Electric Company has received articles of incorporation. The purpose is to acquire and develop water powers and storage reservoirs on the Moose and other rivers in northern Vermont and to develop hydroelectric plants for the sale of energy in Caledonia and Essex Counties. The subscribers are Theodore W. Chase, Passumpsic; Fred D. Gilman, Harry H. Carr, Truman A. Pierce and Charles C. Braley, all of St. Johnsbury. The capital is $200,000.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company is making extensions of its distribution system in North Egremont.

BRIDGEPORT, CONN.—It is stated that the United Electric Light & Water Company of Connecticut is planning to construct a large generating station on the Housatonic River, near here, to supply light and power in the Naugatuck Valley and sell energy in bulk to lighting companies in New Haven and this city, and to the New York, New Haven & Hartford Railroad.

EAST NORWALK, CONN.—A project has been set on foot to consolidate the municipal electric light plants of this place and of South Norwalk. Citizens of this town have declared against the immediate sale of the plant, and a committee of five has been appointed to procure bids.

NIAGARA FALLS, N. Y.—The City Council has authorized the expenditure of $10,000 for the illumination of the falls, the money to be used in carrying out plans submitted by the American Lighting Company, of Chicago. It is proposed to use 100 lamps of 1,000-watt capacity.

PERRY, N. Y.—The Chamber of Commerce is advocating the installation of a boulevard lighting system in the business district.

PORT JEFFERSON, N. Y.—The Public Service Commission has authorized the North Shore Electric Light & Power Company, of this city, to issue $53,000 in five-per-cent first-mortgage bonds and $20,000 capital stock with which to purchase the property and rights of the Port Jefferson Electric Light Company.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has purchased for its new hydroelectric plant here two 12,500-kilovolt-ampere, 11,000-volt, three-phase, 60-cycle, 180-revolutions-per-minute Westinghouse generators with direct-connected exciters.

FREEHOLD, N. J.—The Monmouth County Electric Company has made application to the Board of Public Utility Commissioners for permission to issue stock for $325,000, to be used for extensions and improvements. The company has recently been taken over by new interests.

GLEN GARDNER, N. J.—A board of trade has been organized here and one of its first considerations will be the installation of a street-lighting system.

TRENTON, N. J.—The New Jersey State Hospital has awarded a contract for the erection of a new power house to DeKempe Brothers, Hoboken, N. J.

COLUMBIA, PA.—The A. M. Byers Company, which operates several steel mills in this district, has contracted with the Edison Electric Company for electrical energy for light and power in the mills. The company has already installed over 800 horsepower in motors.

DU BOIS, PA.—The City Council is considering the installation of a boulevard lighting system.

GREENVILLE, PA.—The Mercer County Light, Heat & Power Company has completed plans for a new power plant, the generating equipment of which will include 250, 500 and 750-kilowatt machines.

LANSDALE, PA.—The Borough is making an expenditure of $20,000 for new equipment in the local electric lighting plant.

MIDLAND, PA.—The Hookstown Light Company has been organized here with a capital of $5,000 to furnish electric service. C. J. Braun, Jr., of Pittsburgh, is treasurer.

PHILADELPHIA, PA. — The Mifflin Chemical Works will build a new power house on Delaware Avenue.

PLATEA, PA.—The Platea Borough Light & Power Company has been organized with a capital of $5,000 by C. H. Allen and others, of Erie, to furnish electric service.

TOWER CITY, PA.—John Pfeiffer, of this city, is treasurer of the following companies which have recently been granted charters, each with a capitalization of $5,000: Lykens Township Electric Company, Heigins Township Electric Company, Berrysburg Electric Company, Hubley Township Electric Company, Killinger Electric Company and Mifflin Township Electric Company.

YORK, PA.—The City Council is considering plans for a new lighting system in George and Market Streets.

ZELIENOPLE, PA.—Bonds in the sum of $12,000 have been voted for the betterment of water supply and the acquisition of an electric-lighting plant.

FREDERICK, MD.—Supporters of the proposed $65,000 electric-lighting plant were defeated at an election held recently.

WARWOOD, W. VA.—The Wheeling Electric Company has been granted the contract for furnishing and installing 100 street lights in Warwood.

WHEELING, W. VA.—The Wheeling Traction Company is erecting a high-tension tranmission line to the Wegee coal mine near here, where modern electrical equipment will be installed.

APEX, N. C.—An election will be held soon to vote on a proposition to issue $12,000 electric-light bonds.

KERNERSVILLE, N. C.—An issue of $10,000 in bonds is proposed, the proceeds to be used for the installation of an electric-lighting system.

COCHRAN, GA.—The city has authorized the issuance of $20,000 in bonds, the proceeds to be used for extensions to the electric-lighting and water systems.

NORTH CENTRAL STATES.

CINCINNATI, O.—One of the largest power plants of the Millcreek district will be that of the Ault & Wiborg Company's coloring works at St. Bernard, contracts for which are being let by Tietig & Lee, architects.

CLEVELAND, O.—The Northern Ohio Traction & Light Company has asked the authority of State Utilities Commission to issue $14,075,000 in five-per-cent bonds. The proceeds netted by the issue would be used to refund outstanding bonds, retire present obligations of the company and for contemplated improvements estimated to cost $1,955,300.

DOVER, O.—The City Council has taken the first steps toward adding a generating unit to the municipal plant. The proposed unit will be of 500-kilowatt capacity, and will be installed at an estimated cost of $41,900.

MASSILLON, O.—Plans and specifications for a new street-lighting system, prepared by H. O. Swoboda, consulting engineer, Pittsburgh, Pa., have been approved by the City Council.

OXFORD, O.—The City Council has instructed the light board to prepare plans and specifications for the new machinery required and improvements needed for the local electric-lighting plant.

WARREN, OHIO.—To take care of the increased demand for energy made upon the Trumbull Public Service Company, operated by Henry L. Doherty & Company, improvements and additional equipment will be installed here. A new system of mechanical coal handling and automatic stokers will be installed, and a new boiler room erected. The Trumbull Company has been burning mine-run coal at considerable expense, but plans have been made for the efficient burning of slack coal, which in price is much lower than the former grade coal. Supplementing the present generating capacity, a 6,000-kilowatt unit will be installed, bringing the total capacity of the plant up to 14,000 kilowatts.

WEST MILTON, O.—The Stillwater Valley Electric Light Plant, of which L. A. Pearson is owner, has just completed an extension of its transmission lines to Laura, O., where energy will be supplied for street lamps and private consumption. Four contractors are busy wiring houses, and Ward James will establish an electrical merchandising business. The Stillwater plant recently has made a large number of electrical installations in the neighboring rural districts.

CROTHERSVILLE, IND.—The Town Board has granted Frank Brady a franchise to operate an electric-lighting plant here.

ALTON, ILL.—City officials are considering the installation of new street-lighting units.

AURORA, ILL.—The preliminary survey work for the Aurora, Mendota & Western Electric Railroad began at Aurora and will be pushed forward as rapidly as possible. After the survey has been completed an outline of the route will be presented to the Illinois Public Utilities Commission.

BONE GAP, ILL.—The work of erecting a new electric-lighting plant is progressing and this city will soon be furnished electric service.

PEORIA, ILL.—The Association of Commerce is making plans for improvements to the street-lighting system.

PITTSFIELD, ILL.—Plans are being made for the installation of an electric-lighting plant here by the Village Board of Pleasant Hill. The plant will probably be operated as a private enterprise and later be taken over by the village.

TEUTOPOLIS, ILL.—The Village Board, of which George Kitten is president, is planning ways and means to secure an electric-lighting system.

WOODSTOCK, ILL.—The city lighting system is considered unsatisfactory, and the Council will issue bonds for improvements or will sell the plant to a private company.

ALPENA, MICH.—The Onaway Electric Light & Power Company will build a new dam at the site of the present dam on the Black River, near Tower.

HESPERIA, MICH.—At a special election held here the voters decided to grant to John A. Reed and Frank H. Speese, of Whitehall, a 30-year electric-lighting franchise, a 30-year lease of the dam and water right on White River, owned by the village of Hesperia. They also have an option on the water right at Ferry on the North Branch River and expect to develop enough power to supply the small towns of southern Oceana and northern Muskegon Counties.

IRON MOUNTAIN, MICH.—The Iron Mountain Electric Light Company has pe-

titioned for an extension of its franchise, and improvements will be made if it is granted.

PLYMOUTH, MICH.—The Detroit Edison Company has made the village of Plymouth an offer of $50,000 for the local electric-lighting plant.

ALTOONA, WIS.—Plans are being made here for the establishment of a municipal electric-lighting plant.

BEAVER DAM, WIS.—The City Council has decided to adopt the ornamental post system for lighting the business streets.

HEBRON, WIS.—The Village Board has granted an electric-lighting franchise to the L. E. Meyers Company.

MILWAUKEE, WIS.—The Common Council has decided in favor of municipal ownership of the new street-lighting distribution system.

OREGON, WIS.—The Village Board has accepted a proposition from the Oregon Electric Company for the construction and operation of an electric-lighting plant. The contract is for a period of 10 years.

RHINELANDER, WIS.—The Rhinelander Light & Power Company's power plant at Hat Rapids is being remodeled under the direction of E. A. Forbes. The entire power house will be reconstructed and a new switchboard installed.

WAUWATOSA, WIS.—The Common Council has passed a resolution calling for the signature of an indeterminate street-lighting contract offered by the Milwaukee Light, Heat & Power Company. The contract provides for an increase of 66 lamps and for an initial installation of 220 60-candlepower and eight 250-candlepower gas-filled lamps to be equipped with band refractors.

EARLVILLE, IOWA.—The Town Council has approved a contract with the Iowa Electric Company, of Cedar Rapids, to furnish electrical energy for the city's street-lighting system.

LETTS, IOWA.—Local business men are being interviewed regarding the improvement of electric-lighting and power service. It is proposed to build a line connecting Letts with a nearby town and transmit sufficient energy to furnish light and power to the town and neighboring rural districts.

MUSCATINE, IOWA.—The electric light committee, John Ficken, chairman, is planning to install a boulevard lighting system on several streets.

WADENA, IOWA.—The matter of granting an electric franchise to C. Miller & Sons is under consideration.

WORTHINGTON, IOWA.—The Iowa Electric Company, of Cedar Rapids, has submitted a proposition to furnish electrical service in this city. The proposition will be considered at a special election to be held July 3.

BROOKFIELD, MO.—The city is considering plans for the construction of an electric-lighting plant and a water system.

KANSAS CITY, MO.—The mayor has approved the recommendation of S. F. Scott, supervisor of lights, that tungsten lamps replace arc lamps for street lighting. The city has 1,690 arc lamps, and Mr. Scott has reported that $15,000 can be saved by the change.

MARYVILLE, MO.—C. C. Hellmers, manager of the Maryville Electric Light Company, is constructing a transmission line from Clearmont to Burlington Junction, and one from the latter place to Maryville. The Clearmont City Council has voted to install a street-lighting system.

SMITHTON, MO.—S. V. Monsees, of Sedalia, has secured the contract to install an electric-lighting plant here.

LEAVENWORTH, KANS.—The City Commissioners have taken steps to substitute electric street lamps for the present gas lamps.

NORCATUR, KANS.—The Council has closed a contract to secure electric service from Oberlin.

TOPEKA, KANS.—The City Commissioners are considering lighting the city parks with clusters of globes and eliminating the arc lamps.

BANCROFT, NEB.—Bonds in the sum of $12,000 have been authorized for the construction of a municipal electric-lighting plant.

BENNETT, NEB.—Final arrangements have been made for the installation of an electric-lighting plant here, the project being financed by Fred Steiber.

FAIRBURY, NEB.—A. F. Kollman will head a stock company that is being organized to furnish electrical energy to the towns of Daykin, Western and Plymouth if suitable franchises can be obtained. The company will be capitalized at $25,000.

ONIDA, S. D.—A petition is being circulated here asking the City Council to call a special election to vote on the issuance of bonds for the purchase of the local electric-lighting system.

DUNN CENTER, N. D.—Plans are being considered here for the establishment of a municipal electric-lighting plant.

FORDVILLE, N. D.—The owners of the Fordville garage are preparing to furnish electric-lighting service here. Estimates on the cost of a plant have been secured, and a franchise will be asked for soon.

DATES AHEAD.

Public Utilities Association of West Virginia. Annual convention, Parkersburg, W. Va., July 12-14. Secretary, W. C. Davisson, Charleston, W. Va.

Ohio Electric Light Association. Annual convention, Cedar Point, O., July 18-21. Secretary, D. L. Gaskill, Greenville, O.

National Electrical Contractors' Association of the United States. Annual convention, Hotel McAlpin, New York City, July 19-22. Secretary, G. H. Duffield, 41 Martin Building, Utica, N. Y.

International Association of Municipal Electricians. Annual convention, Baltimore, Md., August 22-25. Secretary C. R. George, Houston, Tex.

Association Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 4-7. Secretary George C. Holberton, San Francisco, Cal.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 5-8. Secretary H. N. Muller, Duquesne Light Company, Pittsburgh, Pa.

Illuminating Engineering Society. Annual convention, Philadelphia, Pa., September 18-21. Secretary, C. A. Littlefield, Irving Place and Fifteenth Street, New York City.

Association of Iron and Steel Electrical Engineers. Annual convention, Chicago, Ill., September 18-22. Secretary, W. O. Oschmann, Oliver Steel & Foundry Company, Pittsburgh, Pa.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 19-20. Secretary, R. H. Starrett, 15 Dey Street, New York City.

SOUTH CENTRAL STATES.

LANCASTER, KY.—The Light & Development Company, of St. Louis, has purchased the plant and business of the Lancaster Electric Light Company, and takes possession at once. The management of the plant is in the hands of Roy Schooler.

NEWTON, TENN.—The Newton Light & Power Company has been incorporated with $2,500 capital by R. W. Clemmer, W. A. Prince and others.

DECATUR, ALA.—The city has voted in favor of the issuance of $50,000 in bonds, the proceeds to be used for the erection of an electric light and power plant.

FAIRHOPE, ALA.—Proposed improvements for this city include a municipal electric-lighting plant.

MONTGOMERY, ALA.—If the Public Service Commission will give its consent the Alabama Power Company will take over the electric lighting plants at Curley and Lineville. Applications for permission to make the transfer have been filed and will be heard at the August session.

EDWARDS, MISS.—Plans are being prepared for an electric-lighting plant for this city by X. A. Kramer, consulting engineer, of Magnolia, Miss.

FLORA, MISS.—The city has adopted plans prepared by X. A. Kramer, of Magnolia, Miss., for an electric-lighting system. The engineer will invite bids on material and equipment.

LEACHVILLE, ARK.—E. Johnson and J. T. Alford, of Blytheville, Ark., have been granted a franchise to erect an electric-lighting plant to cost about $5,000.

WHITE CASTLE, LA.—Plans for electric-lighting and water plants are being considered here.

CUSHING, OKLA.—The contract for additional equipment for the municipal electric-lighting plant has been awarded to the N. S. Sherman Machine & Iron Works Company, of Oklahoma City. The Western Electric Company, through its Kansas City office, was given the contract for a 90-kilowatt generator and switchboard equipment.

DURANT, OKLA.—The City Council has passed a resolution to sell the municipal electric-lighting plant to the Durant Ice & Light Company. The consideration is $18,500 and a contract governing rates the company may charge. The city plant has been idle for some time.

McCURTAIN, OKLA.—The city is planning to issue $20,000 in bonds to construct an electric-lighting system.

DALLAS, TEX.—The City Commission has awarded the contract for rewiring the lighting system on the Dallas-Oak Cliff viaduct to the Jones-Duff Electric Company, of this city.

MARLIN, TEX.—The Marlin-Temple Interurban Promotion Company has been incorporated by G. W. Glass and W. W. Turner, of Marlin, and others. Chief Engineer S. D. Hanna is preparing plans and surveys for the construction of the proposed electric railway from Marlin to Temple.

SHINER, TEX.—The State's Attorney has approved an issue of $12,000 in bonds, the proceeds to be used in constructing an electric-lighting plant here.

TEXAS CITY, TEX.—The bid of the Lawrence Electric Company, of Galveston, for the construction of a street-lighting system in Texas City has been accepted by the City Commissioners.

WESTERN STATES.

FAIRVIEW, MONT.—The Jennison Light & Power Company, according to reports, will extend its transmission lines from this city to Sidney. The local plant is being enlarged to care for the increased business.

FLORENCE, ARIZ.—J. S. Douglas will install an electric-lighting plant and water system here.

PHOENIX, ARIZ.—The City Commission has ordered an election for October 3 to vote on the proposition of issuing $600,000 bonds, the proceeds to be used in constructing a municipal electric-lighting plant.

TEMPE, ARIZ.—The City Council is considering plans for the construction of a municipal electric-lighting plant here to cost about $26,000.

BATTLE MOUNTAIN, NEV.—A petition has been submitted to the County Commission by citizens of Battle Mountain for an extension of the lighting system.

BOISE, IDAHO.—According to recent reports, the Electric Investment Company, of Boise, submitted the highest bid on the power advertised for sale, developed by the Arrow Rock dam, of the United States Reclamation Service. It is stated the dam will be greatly helped financially since returns from the lease will be practically net profit to the project. The contract has been approved by the authorities at Washington for the leasing of the electric power plant built by the Reclamation Service on the Boise River, near Barbur, to the Electric Investment Company, which controls a chain of power plants supplying this section. The term of the lease is five years, with provision for termination on one year's notice, whenever the Reclamation Service desires to utilize its power for pumping irrigation water. The company will take over the operation of the plant about July 1, and will operate it in conjunction with its several other hydroelectric plants along Snake River for supplying Boise and surrounding territory, including the Gem irrigation district. The Reclamation Service reserves sufficient electric power for use in operating the four electric excavators now at work in the Nampa and Meridan Drainage, and also reserves sufficient power for taking care of the requirements at Arrow Rock dam.

COEUR D'ALENE, IDAHO.—A proposition to issue bonds in the sum of $230,000 for a municipal light and water plant will shortly be submitted to voters of this city at a special election.

HAILEY, IDAHO.—The construction of a transmission line to the Federal Milling & Smelting Company's plant is planned by the Hailey Electric Company to furnish energy for equipment to be installed.

LAVA, IDAHO.—The Public Utilities Commission has been petitioned by the Utah Power & Light Company for a certificate of convenience and necessity to construct an electric-lighting plant at Lava Hot Springs.

NAMPA, IDAHO.—According to present plans, the Oregon Short Line Railway Company will construct a large roundhouse in Nampa, same to contain an electric turntable.

NORTH YAKIMA, WASH.—It is reported that the Pacific Power & Light Company, of Portland, Ore., operating in North Yakima and other cities in this section, plans

the construction of a steam electric plant in North Yakima.

OKANOGAN, WASH. — The Okanogan Valley Power Company, Eugene Enloe, president, which serves practically every town and village in the Okanogan country with electrical energy for lighting and power, and which operates a plant on the Methow River near Pateros, recently purchased the plant of the Similkameen Power Company near Oroville, for a consideration said to be $51,000. President Enloe states his company plans an expenditure of $250,000 in developing the Oroville plant and in extending transmission lines throughout the Okanogan district. The present Similkameen plant develops about 350 horsepower, and this will be increased, according to present plans, to about 4,000 horsepower. The company also plans the erection of 40 miles of transmission lines. It is reported active construction in developing the plant and extending lines will begin shortly after the first of next year.

PALOUSE, WASH.—The City Council has been petitioned for a 25-year franchise by M. C. Osborn, representing the Washington Water Power Company, of Spokane, for electric lighting in this city. The company will rebuild the local system, in case the franchise is granted. As the franchise held by the company has 12 years to run, the Council is opposed to granting the franchise.

SEATTLE, WASH.—The Lake Forest Light & Power Company has been granted a franchise in the Lake Forest second and third additions.

SPOKANE, WASH.—Articles of incorporation of the Sumpter Power & Water Company have been filed by R. E. Strahorn, A. G. Smith and R. J. Danson, all of Spokane. The company plans the development of waterpower sites and the distribution of electrical energy and water. The capitalization is $100,000.

SPOKANE, WASH.—D. L. Huntington, C. S. MacCalla and H. L. Bleecker, all officials of the Washington Water Power Company, of Spokane, have incorporated the Spokane Service Company, as a subsidiary of the Washington Water Power Company. The company will engage in the electric and steam heating business and is capitalized at $25,000.

STANWOOD, WASH.—Warren Marshall, of Boston, appeared before the City Council recently with a proposal to take over the Stanwood Light & Power Company, providing the city will grant him the necessary franchise.

UNIONTOWN, WASH.—The Washington Water Power Company is extending its transmission lines to this city, and plans are being made to install a new street-lighting system here.

COVE, ORE.—Extensive improvements are being made by the Eastern Oregon Light & Power Company at its plant near this city. It is unofficially reported that the company plans the installation of additional equipment to care for increasing business.

PORTLAND, ORE.—City Auditor R. L. Barbur will shortly issue a call for bids for supplying a multistage turbine pump, direct connected to a 200-horsepower electric motor.

SILVERTON, ORE.—It is reported that the Silver Falls Timber Company will electrify its railroad from Silverton to its logging camps, and that the Willamette Valley Southern, financed by the Portland Railway, Light & Power Company, will be extended to Silverton this fall.

CEDARVILLE, CAL.—The Surprise Valley Electric Light & Power Company has filed an application with the Railroad Commission for permission to sell 145 shares of stock at $50 par, the proceeds to be used to pay existing debts and $400 for installation of meters.

LOS ANGELES, CAL.—The City Council has ordered an ordinance drawn providing for the installation of an ornamental lighting system on Wilshire Boulevard, using reinforced concrete lamp posts with single globes.

MARTINEZ, CAL.—The Martinez-Concord Electric Railway has been granted a franchise within the city limits, and the contract will be let shortly for construction work on Pine Street and Pacheco Avenue.

MODESTO, CAL.—The contract for lighting the streets of the town of Ceres for five years has been awarded to the Yosemite Power Company. The contract calls for the installation of a new system.

NOVATO, CAL.—A 25-year franchise has been granted to the Novato Utilities Company, William Kane, president, to supply electrical energy for light and power to this city and vicinity.

OAKLAND, CAL.—A high-tension cable, designed to carry between 3,000 and 4,000 horsepower, was laid under the estuary immediateiy east of the Southern Pacific drawbridge the past week by the Pacific Gas & Electric Company. It will transmit power to the plant of the Union Iron Works on the Alameda side of the estuary.

SACRAMENTO, CAL.—According to C. F. Adams, engineer of the Sierra Electric Company, who testified before the Railroad Commission, his corporation hopes to supply electric power for irrigation to many of the land owners of the reorganized Kuhn project.

WILLIAMS, CAL.—The Northern California Power Company has decided to extend its line from Arbuckle to Dunnigan upon recommendation of C. H. Giptill, district manager of the company. The cost of the proposed extension is estimated at $20,000. The voltage between here and Arbuckle will be raised from 6,600 to 11,000, making it necessary to enlarge the transformers at Arbuckle. Ten and one-half miles of new line will be built from College City to Dunnigan.

WOODLAND, CAL.—Sealed bids will be received by Supervisors of Yolo County up to July 11 for a franchise to erect poles and wires for transmitting electrical energy along certain highways of the county, application for such a franchise having been made by the Northern California Power Company.

CANADA.

MOOSE JAW, SASK.—The City Council is planning to make an expenditure of $12,300 for extensions and the installation of new equipment in the local power plant.

EDMONDS, B. C.—Permission has been granted the Western Canada Power Company by the Council to construct transmission lines on the Cariboo road.

NELSON, B. C.—It is reported the French Complex Ore Reduction Company plans the installation of an electrical zinc smelting plant near Nelson.

Proposals

ELECTRICAL CONSTRUCTION.—Sealed will be received until July 17 for the electric wiring at the Sowinski School, Cleveland, O. Frank G. Hogan, director of schools.

ELECTRICAL CONSTRUCTION.—Sealed bids will be received until July 12 for constructing an electric-lighting plant at Baldwyn, Miss. The specifications include oil engines, generators and switchboard, distribution and street-lighting systems. W. A. Stocks, mayor.

GENERATING EQUIPMENT. — Sealed proposals will be received until July 26 by H. M. Robertson, superintendent of the water and light department, Wahoo, Neb., for a 225-horsepower engine and direct-connected generator, one 25-horsepower motor and one triplex pump.

ELECTRICAL CONSTRUCTION.—Bids will be received until July 6 for the construction of an electric-lighting system at Goodman, Miss. The specifications include oil engine, generator, switchboard, transformers, electric distribution and street-lighting systems. A. N. Roberts, city clerk.

ELECTRIC ELEVATOR.—Sealed proposals will be opened in the office of the supervising architect's office, Treasury Department, Washington, D. C., at 3 p. m., August 2, 1916, for the installation complete of an electric freight elevator and remodeling two electric passenger elevators in the United States customhouse, New Orleans, La., in accordance with the drawing and specification, copies of which may be had at that office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 21,541. ELECTRICAL EQUIPMENT.—A man from South America, who is now in the United States, is in the market for dynamos, lamps and all kinds of electrical equipment to be used by municipalties. Quotations f. o. b. New York. Goods will be paid for against documents in New York. Reference is given.

NO. 21,553. ELECTRIC MOTORS AND DYNAMOS.—A firm in Russia wishes to receive catalogues and quotations from American manufacturers of dynamos, and electric motors for oil-well drilling. Further particulars may be obtained from the bureau or its district offices.

New Incorporations

ELKHART, IND.—Sevison Electric Company has increased its capital stock from $10,000 to $100,000.

CLIFTON FORGE, VA.—Virginia-Western Power Company has increased its capital from $500,000 to $1,000,000.

CLEVELAND, O.—Electric Construction & Sales Company has increased its capital stock from $20,000 to $30,000.

CEDAR RAPIDS, IOWA.—Iowa Railway & Light Company has increased its capital stock from $6,000,000 to $8,000,000.

CHICAGO, ILL.—Amber Electric Construction Company. Capital, $20,000. Electrical contracting. Incorporators: R. L. Lehr, L. Cleary and J. V. Cleary.

BUFFALO, N. Y.—Deitz New York Company. Capital, $4,000. Manufacture electrical specialties. Incorporators: J. T. Snyder, E. E. Harris and R. W. Werner.

CLINTON, N. Y.—Cen-Ke Manufacturing Company. Capital, $5,000. Manufacture electrical devices. Incorporators: G. A. Centolella, W. V. Keith and J. P. Kelly.

SIOUX FALLS, S. D.—Electric Construction Company. Capital, $20,000. Electrical contracting. Incorporators: W. Claus, R. Claus, F. W. Cook and E. Cook.

BEVERLY, N. J.—Standard Electrical Appliance Company. Capital, $15,000. Manufacture electric appliances. Incorporators: Franklin P. Jones, Sr., and Jr., and George E. Huff, Beverly.

DOVER, DEL.—Albia Light & Railway Company. Capital, $500,000. To operate electric lighting and railway properties. Incorporators: Merle R. Walker, A. L. Fowle, and A. S. Leland, New York City.

DOVER, DEL.—Lyford Land & Loan Company. Capital, $1,200,000. To operate electric light and power, and gas properties. Incorporators: Wm. F. O'Keefe, George G. Stiegler and E. E. Wright, Wilmington, Del.

POUGHKEEPSIE, N. Y.—Poughkeepsie Storage Battery Company. Capital, $12,000. Manufacture storage batteries and electrical appliances. Incorporators: J. H. Dingman, Frederick Wright and W. C. Dingman.

Financial Notes

The franchise of the Louisville Gas & Electric Company is assessed at $10,841,492, an increase of $2,458,696 over last year, by the Kentucky Board of Valuation and Assessment.

Stockholders of Northern States Power Company have approved increases in preferred stock from $14,000,000 to $50,000,000 and in common stock from $16,000,000 to $50,000,000. Directors of the company are authorized to issue the new stock as needed for improvements. There will be no new stock issued at this time.

The Nevada, California & Oregon Telephone & Telegraph Company has filed with the California Railroad Commission an application for authority to issue $15,000 six-per-cent bonds, due in 1954, at 80 per cent of par, to raise $12,000 with which to build a toll line 25 miles in length between Alturas and Cedarville and make other improvements.

Philadelphia Rapid Transit has now reported 11 months of the fiscal year, and with June surplus earnings equal to those of May the amount earned for the stock in the 12 months would be nearly $1,725,000 or 5.75 per cent on the $30,000,000 stock. This more than realizes earlier expectations and is by far the best showing ever made by the company.

The San Joaquin Light & Power Company has applied to the California Railroad Commission for authority to issue and sell $1,000,000 par value of its first and refunding mortgage series C six-per-cent bonds, to raise money to reimburse the company's treasury for betterments, to pay certain notes, and to pay for transformers. The transformers are expected to cost $232,000.

The directors of the Hartford (Conn.) Electric Light Company have voted to recommend to the stockholders of the company that the capital stock be increased from $3,000,000 to $4,500,000. The 9,000 shares thus created will be offered to the stockholders on record at the time of the offer at par value, $100. Any of the stock not disposed of in this way will be sold at whatever figure it will bring.

New York Up-State Public Service Commission has authorized the absorption of the Elmira Transmission Company and the Elmira & Seneca Lake Traction Company by the Elmira Water, Light & Railroad Company, which is also granted permission

to issue $100,000 of its five-per-cent first-consolidated mortgage bonds at not less than 92.5; $125,000 seven-per-cent cumulative preferred, and $200,000 five-per-cent second-preferred stock, both at par, netting in all $417,500. On this amount $63,570 will be used to pay for new construction.

Dividends.

	Term.	Rate.	Payable.
Am. Pw. & Lt., pf.	Q	1.5 %	July 1
Am. Pub. Service, pf.	Q	1.75%	July 1
Am. Telephone	Q	2 %	July 15
Bangor Ry. & Elec., pf.	Q	1.75%	July 1
Birm. Ry., Lt. & Pw., pf.	—	3 %	June 30
Birm. Ry., Lt. & Pw., pf., accum.	—	1 %	June 30
Brooklyn City	Q	2 %	July 15
Cal. Elec. Gen., pf.	Q	1.5 %	July 1
Capital Trac., Washington	Q	1.25%	July 1
Cent. & S. Am. Teleg.	Q	1.5 %	July 8
Chicago City Rys.	Q	2 %	June 30
Cin. & Ham. Trac.	Q	1 %	July 1
Cin. & Ham. Trac., pf.	—	.25%	July 1
Cin. Sub. Bell Tel.	Q	2.5 %	July 1
Cin. St. Ry.	Q	1.5 %	July 1
Col., Newark & Z., pf.	Q	1.5 %	July 1
Con. Trac., N. J.	S	2 %	July 15
Cont. Gas & Elec.	Q	.5 %	July 1
Cont. Gas & Elec.	Q	1.5 %	July 1
Detroit Edison	Q	2 %	July 15
Duquesne Light, pf.	Q	1.75%	Aug. 1
Gen. Gas & Elec., Crem., pf.	Q	1.75%	July 1
Halifax Elec. Tram.	Q	2 %	July 3
Harrisburg Lt. & Pw., pf.	Q	1.5 %	June 27
Interstate Elec. Corp., com.	—	1 %	July 1
Interstate Rys., pf.	S	3 %	July 1
Iowa Ry. & Lt., pf.	Q	1.75%	June 30
Kan. Gas & Elec., pf.	Q	1.75%	July 1
Mass. Ltg., old	Q	$1.75	July 15
Mass. Ltg., new	Q	25c	July 15
Mass. Ltg., pf.	Q	$1.50	July 15
Mexican Teleg.	Q	2.5 %	July 15
Mich. S. Tel., pf.	Q	1.5 %	June 30
Montreal Teleg.	Q	2 %	July 15
New Eng. Pw., pf.	Q	1.5 %	July 15
New Eng. Tel.	Q	1.75%	June 30
New Orleans Ry. & Lt., pf.	Q	1.25%	June 30
Omaha & C. B.	Q	1 %	July. 1
Omaha & C. B., pf.	Q	1.25%	July 1
Ottawa Trac.	Q	1 %	July 1
Pacific Tel. & Tel., pf.	Q	1.5 %	July 15
Phila. Co.	Q	1.75%	Aug. 1
Phila. & W., pf.	Q	1.25%	July 15
Porto Rico Rys., pf.	Q	1.75%	July 3
Pub. Service of N. J.	Q	2 %	June 30
Republic Ry. & Lt., pf.	Q	1.5 %	July 15
Scioto Val. Lr., first pf.	Q	1.25%	July 1
Southwestern Cities Elec., pf.	Q	$1.75	July 1
Stark Elec.	Q	1 %	July 1
Toronto Ry.	Q	2 %	July 3
Un. Elec. of N. J.	—	2.5 %	July 1
United Gas & Elec., first pf.	Q	1.75%	July 1
Va. Ry. & Pw., pf.	S	3 %	July 30
Wash. Water Pw., pf.	Q	$1.00	July 1
West. Penn. Pw.	Q	1.75%	Aug. 15
West. Phila. Pass.	—	$5.00	July 1
Westinghouse Elec. & Mfg. Co., com.	Q	1.5 %	July 31
Westinghouse Elec. & Mfg., pf.	Q	1.75%	July 15
York Rys., pf.	—	2.5 %	July 31

Reports of Earnings.

NORTHERN STATES POWER COMPANY.

	1916	1915
May gross	$448,802	$374,830
Net after taxes	237,347	202,713
12 months' gross	5,546,573	4,688,438
Net earnings	3,090,014	2,584,863

As of April 30, 1916, the connected load of Northern States Power and subsidiaries was 168,547 kilowatts compared with 139,547 kilowatts April 30, 1916, and the customers numbered 70,823 compared with 58,757. The present connected load consists of 96,149 kilowatts in lighting and 90,235 kilowatts in motors. For the year connected load increased 21.19 per cent and gross increased 18.30 per cent, with a gain of 19.54 per cent in net.

NEW YORK TELEPHONE.

Operating income of the New York Telephone Company for April increased 13 per cent over April, 1915, and for the four months ended April, 1916, the increase was 21 per cent over the corresponding period of 1915. The number of stations was 1,163,894 for April, 1916, an increase of 10 per cent over the preceding year. Statistics for the four months ended April, 1916, follow:

	1916	1915
Subscribers' station revenues	$12,172,051	$10,712,556
Public pay station revenues	2,047,897	1,586,240
Total operating revenue	17,071,217	15,577,256
Plant and equipment depreciation	3,021,313	2,852,410
Other maintenance	2,008,505	2,000,786
Traffic expense	3,404,836	3,013,092
Operating expense	10,756,312	10,314,101
Net operating revenue	6,314,905	5,263,155
Operating income	5,200,921	4,307,613

Depreciation and other maintenance amounted to $1,304,911 for April, 1916, an increase of 4 per cent over April, 1915; the increase in this item for the four months was 4 per cent compared with the corresponding period of a year previous.

CHICAGO TELEPHONE.

Operating income of the Chicago Telephone Company for April increased 3 per cent over April, 1915, and for the four months ended April, 1916, the increase was 12 per cent over the corresponding period of 1915. The number of stations was 522,321 for April, 1916, an increase of 9 per cent over April of the preceding year. Statistics for the four months ending April, 1916, follow:

	1916	1915
Subscribers' station revenues	$5,271,803	$4,790,477
Public pay station revenues	598,606	492,423
Total operating revenue	6,357,585	5,670,773
Plant and equipment depreciation	1,163,591	1,073,009
Other maintenance	867,872	819,796
Traffic expense	1,432,265	1,182,505
Telephone operating expense	4,435,589	3,951,492
Net operating revenues	1,921,995	1,719,281
Operating income	1,520,869	1,357,255

Depreciation and other maintenance amounted to $518,479 for April, 1916, an increase of 6 per cent over April, 1915; the increase in this item for the four months was 8 per cent over the corresponding months of the previous year.

CITIES SERVICE.

	1916	1915
May gross	$709,085	$287,365
Net after expenses	688,973	273,007
Surplus after charges	644,852	232,174
Balance after preferred dividends	473,497	101,341
Five months' gross	3,324,306	1,791,138
Net after expenses	3,227,873	1,723,192
Surplus after charges	3,010,253	1,519,027
Balance after preferred dividends	2,166,546	864,862
Twelve months' gross	6,012,969	3,952,800
Net after expenses	5,811,625	3,509,705
Surplus after charges	5,308,171	3,331,372
Balance after preferred dividends	*3,548,624	1,725,376

*Equivalent to 21.98 per cent earned on the common stock as compared with 11.41 per cent for preceding 12 months.

Combined gross of subsidiaries for 12 months ended April 30, 1916, were $25,103,110, as compared with $19,757,592 for 12 months ended April 30, 1915. Combined surplus and reserves of Cities Service Company June 1, 1916, $7,211,552.

DAYTON POWER & LIGHT COMPANY.

	1916	1915
Gross earnings	$122,589	$77,257
Operating expense	68,417	44,434
Net earnings	54,172	32,823
Non-operating revenue	1,241	1,031
Total income	55,413	33,854
Interest on bonds	15,204	15,288
Other interest and sinking fund	4,094	2,797
Total deductions	19,298	18,085
Net income	36,115	15,769
Dividend on preferred stock	14,813	10,532
Surplus	21,302	5,237

UTAH SECURITIES CORPORATION.
(Combined earnings of subsidiaries.)

	1916	1915
May gross	$ 440,317	$ 387,314
Net after taxes	238,397	188,912
Six months' gross	2,641,630	2,267,299
Net after taxes	1,470,243	1,151,749
Twelve months' gross	5,133,314	4,600,885
Net after taxes	2,804,116	2,265,035

Electrical Patents

The weekly record of United States electrical patents published in these columns is based on the *Official Gazette* issued by the United States Patent Office. The issues of the *Gazette* for June 20 and June 27 are unavoidably delayed because of lack of appropriations, and it will not be possible to publish the list of patents issued on those dates until some time after July 1.

PATENTS EXPIRED.

The following United States electrical patents expired on June 27, 1916:

627,465. Telephone Index. H. L. Allen, Hartford, Conn.

627,471. Controller for Motors. M. K. Bowen and G. W. Knox, Chicago, Ill.

627,475. Electric Railway. W. M. Brown, Johnstown, Pa.

627,476. Contact-Box for Electric Railways. W. M. Brown, Johnstown, Pa.

627,477. Electric Railway. W. M. Brown, Johnstown, Pa.

627,486. Globe-Holding Device for Electric Arc Lamps. T. E. Drohan, Chicago, Ill.

627,487. Globe. T. E. Drohan, Chicago, Ill.

627,488. Frame or Yoke for Dynamo-electric Machines. C. A. Eck, Newark, N. J.

627,494. Storage Battery. W. P. Freeman, New York, N. Y.

627,495. Overhead-Trolley System. E. Frischmuth, Berlin, Germany.

627,502. Motor-Connecting Box for Electric-Railway Vehicles. S. Hendrie, Detroit, Mich.

627,519. Electrical Connecting Cord. C. H. McEvoy, Lowell, Mass.

627,530. Electrical Speed Indicator. A. Raps, Berlin, Germany.

627,531. Dynamo-electric Machine. W. H. A. Rotth, Berlin, Germany.

627,549. Electric Controller. G. Valley, Johnstown, Pa.

627,565. Electric Traction Motor. R. W. E. Zander, Charlottenburg, Germany.

627,573. Electrode. C. C. Connor, Belfast, Ireland.

627,577. Telephone. C. F. Dunderdale, Chicago, Ill.

627,641. Battery. V. Halski, Lemburg, Austria-Hungary.

627,686. Automatic Electric Switch. J. L. Creveling, New York, N. Y.

627,736. Electric Coin-Feed Apparatus. J. H. F. Krull, Hamburg, Germany.

627,759. Joint for Electric Conductors. H. E. Nelld, London, England.

627,772. Electrohydraulic Brake for Railway Vehicles. C. Durey, Paris, France.

627,784. Conduit for Electrical Conductors. C. H. Sewall, Chicago, Ill.

627,799. Telegraphic Sounder. J. H. Bunnell, New York, N. Y.

627,813. Telephone-Circuit and Switching Apparatus. T. C. Wales, Jr., Newton, Mass.

627,814. Telephone-Exchange Switch Apparatus and Circuits. C. H. Arnold, Boston, Mass.

627,837. Electric Circuit-Closing Device. F. Wilke, Akron, O.

627,866. Telephone Writing-Desk. D. H. Moore, St. Louis, Mo.

627,908. Electrical Measuring Instrument. H. P. Davis.

627,917. Dry Cell. M. E. Fuld, Baltimore, Md.

627,927. Continuous-Contact Trolley. C. B. Lebcher, Plains, Mont.

627,937. Dynamoelectric Machine. L. O. Lieber, Los Angeles, Cal.

627,955. Portable Electric Lamp. A. Doss and W. F. Doss, Denver, Colo.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	June 26.	June 19.
American Tel. & Tel. (New York)	130⅜	130⅝
Commonwealth Edison (Chicago)	143½	141
Edison Electric Illuminating (Boston)	238	238
Electric Storage Battery common (Philadelphia)	62	65¾
Electric Storage Battery preferred (Philadelphia)	62	65¾
General Electric (New York)	166	169
Kings County Electric (New York)	130	130
Massachusetts Electric common (Boston)	6	6
Massachusetts Electric preferred (Boston)	34	34½
National Carbon common (Chicago)	170	170
National Carbon preferred (Chicago)	123	123
New England Telephone (Boston)	134½	134½
Philadelphia Electric (Philadelphia)	28⅞	27½
Postal Telegraph and Cables preferred (New York)	67	68¼
Postal Telegraph and Cables common (New York)	82	81
Western Union (New York)	92⅞	94¼
Westinghouse common (New York)	58¼	60⅝
Westinghouse preferred (New York)	70	70